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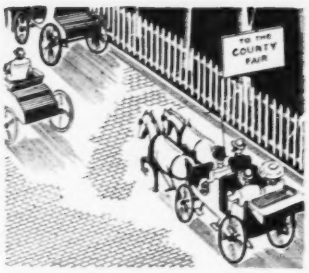
February 4, 1932

Only a Modern BRICK-SURFACED PAVEMENT *Would Do!!!*

Clinton Street, Cleveland, Ohio, from West 28th to West 45th St., resurfaced in 1931

FOR 38 years the brick pavement on Clinton St., Cleveland, served its public well. It extended from West 28th to West 45th St. Laid in 1893, without foundation except the sub-soil and a sand cushion, it was pronounced by engineers still in good condition when taken up last year to accommodate the installation of a new sewer down the middle of the street.



Today there is a Modern Brick-Surfaced Pavement on Clinton St.—laid in 1931 on a modern foundation. It is noteworthy that this new brick pavement was laid by the same firm of paving contractors who put down the original brick 38 years ago—The Roehl Bros. Construction Co.

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THE METROPOLITAN PAVING BRICK CO.

CANTON, OHIO

Manufc of Metro Canton, Bessemer, Olean, and Clevel aving Block • Architectural Face Brick • Structural Clay Tile • Metro Trickling Filter Flooring •

BRICK PAVEMENTS

Engineering News-Record

Established 1874 ✦ A Weekly Journal of Civil Engineering and Construction Practice ✦ McGraw-Hill Publishing Company, Inc.

F. E. Schmitt, Editor

Volume 108 | New York, February 4, 1932 | Number 5

ANNUAL SURVEY OF ENGINEERING PROGRESS

THESE are memorable times. Looking about at the opening of 1932 to examine as in past years the progress and condition of the arts of construction, we see these arts under the sway of abnormal influences arising from the violent economic upheaval in which the country is involved. Our material affairs are controlled by paralysis of the money and credit system, while trends of thought are marked by an anxious seeking for industrial stabilization and by corresponding change of attitude toward economic, governmental and social relations. These conditions have borne heavily on construction.

Engineering News-Record therefore presents in this issue the views of leading thinkers on the economic problems which dominate current construction activities, to give the essential background to our annual editorial review of technical progress and our summary of construction facts and figures. Included among the contributors are an eminent economist, two builders known the country over, and the leader of organized labor in the United States. Their statements point out the direction of thought and effort by which engineering construction will ultimately be placed on a more substantial foundation.

A Year of Stress

UNMARKED by outstanding natural events or by important advances in engineering science or technology, the year 1931 was one of great and growing stress due to economic disorganization. Crops were good, and no shortage occurred in any of the supplies on which man depends; yet decreased production and trade, shrinking credit, vanishing profits and steadily extending unemployment affected every phase of human activity. The encouraging prospect that appeared a year ago, indicated in *Engineering News-Record's* last annual review, (Feb. 5, 1931), faded away as the months passed. The anticipated construction program of more than eight billion dollars diminished rapidly, and at the year's end the volume of work done was 25 per cent short of the expected figure.

Unemployment and reduced demand had become formidable even a year ago. During 1931 the roll of unemployed grew by nearly one-half, from less than six millions at the beginning of the year to nearly nine millions, so far as can be estimated in the absence of exact statistics. By July the civil engineering profession began to be involved in severe degree, and ultimately the radical step was taken of organizing local engineering groups to assist their idle colleagues with work, loans and relief—something wholly new in the profession's history. This effect on one prominent element of the construction industry is a fair reflection of what the industry as a whole experienced.

Financial conditions apparently were at the root of the chief developments of the year. Business activity maintained itself on an even keel, promising ultimate upturn, until in May and June credit contraction and bank failures here and abroad became threatening. A moratorium on European governmental debt payments was announced by the President. Later England went off the gold standard, followed by most of the other countries.

In midsummer also the railroads asked the Interstate Commerce Commission for a 15 per cent freight-rate increase as an immediate measure to stave off bankruptcies, but the commission procrastinated hopelessly before it allowed a modest increase (late in the year); a number of lines, the Seaboard and the Wabash among them, went into receivership—a serious blow to credit. Meanwhile banking conditions were getting tighter as security values and marketability decreased, and people were hoarding money to a total of many hundreds of millions of dollars. Everyone, banker and businessman, as well as private citizen, struggled to make his finances as liquid as possible, with the result that credit was further reduced. Such aid as Congress might have extended was not available, as the President did not call a session.

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In late fall a mutual credit corporation was organized by the banks to check failures, but apparently with no significant effect. When Congress finally met, it organized a government corporation, the Reconstruction Finance Corporation, to provide for emergency loans to financial institutions and railroads. This latest development, supported by a half-billion dollar loan from the government, has not yet had time to show results. An even more powerful aid to building, a mortgage discount organization, is still under discussion. Effective credit release through such organizations would prove an important stimulant to construction.

Construction Looks Forward

IF CONSTRUCTION met disappointment last year in shrinking volume of work and sagging prices, it has reason to look forward with courage and confidence. Revival of building is essential to business restoration. The industry has brought its own efficiency to a high pitch and has attained a remarkably low bidding level. Its manpower is in good condition; its equipment, where deteriorated because of deficient renewals, can be quickly readjusted to meet any requirement by virtue of the unimpaired ability of its equipment branch.

Many troubles beset the present and the immediate future, however. Demand is restricted not only by tight credit but also by a widely held belief that cities, utilities and industries are overbuilt. Even the need for continuing roadbuilding has been challenged in recent months —an example of the tendency of some minds in their present stress to revert to a philosophy of limiting the country's work to the satisfaction of bare necessities. Beyond this, construction suffers from doubts as to the ultimate adjustment of wage levels, especially in view of wage legislation; and from intense competition.

Construction budgets are subject to greater uncertainty this year than ever. Data gathered by *Engineering News-Record* indicate a total of slightly over 5.4 billion dollars, or 85 per cent of the 1931 volume and 60 per cent of the peak-year volume. In this total, public works ($3,150 millions) are equal for the two years, utility and industrial construction ($610 millions) is down 30 per cent, and building ($1,650 millions) is one-fifth lower than in 1931. Recent reduction of municipal and state public works may bring the total farther down.

Public Works

THE brightest element of the engineering picture during the past two years has been the fact that public-works activities were maintained at full volume and where possible intensified with a view to counteracting the retardation of industry. No ordinary increase could make up for diminished private work, however. A great emergency increase in public works, financed through national credit, was strongly urged last summer, as it was becoming probable that unemployment would be worse this winter than last. But the plan was as strongly opposed, and, as the administration was hostile and Congress was not called to consider the plan, nothing was done.

Thus, despite much discussion—which included also "timed" public works, a device for future use rather than present relief—public works have figured little more than normally in the construction situation. They have decreased unemployment somewhat through increased roadbuilding with the emergency funds voted by Congress early last spring, and locally through relief work, most of it being minor grading, park and stream cleanup and the like. No increased effect is likely in 1932. On the contrary, public works are being curtailed by many government bodies, due to difficulties of finance and resulting necessity for retrenchment.

Municipal Finance Critical

FINANCIAL troubles of local communities, chiefly cities, after being noticeable during a large part of the past year, turned into a critical phase at the beginning of the current year. Causes include shortage in tax collections due to taxpayers' inability to pay—the aggravated case of Chicago and Cook County is an exception, as it arose from inequitable and illegal assessments—and, as well, active continuance of construction on a base of imprudent financing. Growing deficits finally led to banks refusing cities further credits unless expenditures were curtailed. Hence in the past few months reduction of active and projected public works has occurred in a number of cities, both large and small, together with reduction of engineering and other city forces. This threat to continuance of public-works construction may possibly be removed through the operations of the Reconstruction Finance Corporation or through other governmental emergency aid, but on present outlook will mean a reduction of public works for some time.

States as well as cities are curtailing construction. A number of states are in a financial condition like that of the cities, and feel compelled to retrench. North Carolina has decided to discontinue a large part of its road program. Other states have been unable to sell their bonds advantageously—a difficulty also encountered by some cities. Back of the trouble is a growing demand for lower taxes, coupled with complaints from real estate interests that the tax burden rests too heavily on land and buildings.

Administrative troubles in township and county work induced several states during 1931 to take over part or all of the local functions. Michigan took over part of the county road construction, North Carolina the entire road system in the state. Pennsylvania made an equivalent change by taking a large mileage of local roads into the state system for improvement.

The Building Situation

ADVANCE expectations that building would recover in 1931 were not realized; there was further decline. The general depression forced down rentals, made real estate and buildings difficult to sell or finance, produced many tax sales and foreclosures, and discouraged new enterprise. Real property became the most frozen type of asset, and depreciated accordingly. Because of the large ratio of vacancies, an overbuilt condition appeared. Extensive losses in real estate bonds, partly chargeable to high finance on the part of operators, contributed to the discouragement of new building.

Several significant events bearing on realty and building improvement marked the year. One was the formulation of a plan for unfreezing realty credit by forming a mortgage discount bank similar to the Federal Reserve System, worked out last spring by the National Association of Real Estate Boards. The proposal is now before Congress. Another event was a home-building conference which met in October at the call of the President.

at which exhaustive reports on some thirty major questions of residential building were brought together. Two important findings of the conference were that adequate homes cannot be built for those with incomes below $1,500 per year (this is not far from the average income for the United States), and that present house design and construction methods are antiquated and require thorough modernization.

Price Wars and Industry Stabilization

INTENSE competition in all industry fields, the natural result of demand far below productive capacity, led to some destructive price wars, the most important that in cement, though steel and other materials also sold below cost on a large scale and published price quotations were honored more in the breach than in the observance. Cement prices were cut suddenly in the early months of 1931, as a defense measure of some mills against persistent underbidding. In a short time prices fell below $1 per barrel at mill, and the industry lost heavily. Within the past month a new drop took place, with some bids at 60c. or less at mill—despite the favorable ratio of 1931 sales, which (at 125 to 130 million barrels) were fully 75 per cent of the peak-year production.

The manifest reaction of overproduction on unemployment as well as on profits and solvency directed attention forcibly to the possibilities of industry stabilization. This subject, in fact, was the central element of industry thought during the year. Most of the discussion revolved around relaxation of the anti-trust laws and state or industry insurance of workers against unemployment. Two specific proposals attracted sensational interest: the Swope plan for compulsory trade associations which would administer retirement and unemployment funds, and the American Institute of Steel Construction's production quota plan for the fabricating industry, under which penalties for exceeding the quota would go to the Institute. This plan is awaiting action by the fabricating industry.

State restriction of petroleum production, attempts to bring about state agreements on cotton limitation, and discussion of the possibility of coal-mining restriction, also figure among the year's noteworthy events in the field of stabilization. Other attacks on the subject approached the problem from the side of joint planning and market study by a central agency set up by an industry.

Unifying Construction

ATTEMPTS to carry stabilization thinking into the construction field encountered the obstacle that there is no unified construction industry. Architect, engineer, contractor, material and equipment producer, and worker have divergent interests and points of view, and lack a meeting ground. Knowledge of necessary statistical facts is lacking, as for example data on labor employment and yearly income; unemployment insurance as usually discussed is inapplicable because the worker has no steady place of employment; diverse interests take different attitudes toward legislation. These conditions led last fall to the organization of the Construction League of the United States, as a forum for interchange of data and views among all the component parts of the industry. Architects, engineers and contractors were the prime movers; over 35 national organizations of construction interests are represented, labor included. In one sense this move is the year's leading development in construction.

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Restrictive Movements

VARIOUS restrictive movements that arose during the last year react unfavorably on construction, in part because of their vague and ineffective character. Chief of these are prevailing-rate-of-wages laws, statutes or administrative practices that give preference to local materials or to local labor and contractors, attempts to require the use of hand labor in place of machinery, legislation requiring that contractors be licensed, and such irregular contract practices as wage rebating and bid shopping.

Wage maintenance has been a contentious subject since late in 1929, when the President urged that wage rates be maintained. Despite his plea wages declined more or less continuously throughout the two years, and in 1931 both official and unofficial wage reductions were quite general. Early in the year Congress passed the Bacon-Davis bill, requiring contractors on public works to pay the prevailing rate of wages of the locality in which the work is located; but in the absence of penalties as well as provisions for determining the prevailing rate of wage (except by *ex post facto* decision) it was of doubtful effect. Within the past month the President has ordered all his department heads to enforce the law and to cancel contracts on which it is violated. No method has been developed for fixing wage rates in advance so that a contractor may be enabled to bid intelligently. Several states passed similar laws during the year (in some others such laws already existed); elsewhere the letting authorities attempted to attain the same result by specification in their call for bids. In Illinois the legal uncertainties of such laws led to months of delay in letting many millions of dollars of work, and the law finally was declared invalid. Other state litigation also was unfavorable to wage requirements, holding them incompatible with effective competition.

Local Preference and Hand Labor

LOCAL-PREFERENCE legislation and administrative rules relating to labor have given little trouble, but those relating to materials and contractors proved disturbing. Materials preferences, already established in some states, were enacted by statute in half a dozen other states during 1931; they encouraged destructive price competition, as the out-of-state suppliers had to underbid the preferred local interests in order to receive consideration. The injurious effect of these laws will probably persist. Preference to local contractors was attempted prominently by Massachusetts in several road contracts, but there as also in other states the insistence of the U. S. Bureau of Public Roads on untrammeled competition as a condition of federal-aid payments prevailed.

Pressure of unemployment led to widespread attempts to have public-works construction carried on with as little machinery and as much hand labor as possible—another unprecedented development which evidences the extreme stress of the times. Where force-account work by cities or other local governments was concerned, little difficulty developed, but occasional attempts to let

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contracts on a hand-labor basis in order to provide more work for the unemployed proved troublesome. Usually no clear definition could be given of the nature of the hand operations to be used or the class of tools or machines to be excluded. Opposing hand-labor arguments, a large section of public opinion held to the belief that all public work should be done at greatest efficiency and lowest cost, so that more work can be done with the funds at hand. The subject was a source of contention throughout the year, and because of its unsettled and undefined state remains a potential source of disturbance to sound construction procedure.

Bridges

COMING to specific construction performance, bridges claim first notice, since 1931 was the greatest bridge-building year of history in terms of completion of large structures. Among these were the 3,500-ft. Hudson River suspension bridge and the 1,652-ft. Kill van Kull steel arch bridge in New York, both the longest of their type. Completion of the St. Johns bridge in Portland, Ore., the Ohio River bridge at Maysville, Ky., and the Waldo-Hancock bridge near Bucksport, Maine, marked an impressive introduction of the prestressed twisted-wire strand cable structure into suspension-bridge practice. During the year new span records were set for both railroad and highway lift spans in the 480-ft. M.K.T. bridge at Boonville, Mo., and the 534-ft. Burlington-Bristol bridge over the Delaware River. The latter was the only noteworthy private toll bridge project of the year.

Notable concrete bridges were the Veterans' Memorial arch bridge over the Genesee River at Rochester, N. Y., which was completed, and the multiple-span Rogue River bridge in Oregon, whose construction, utilizing the Freyssinet method of decentering and stress adjustment, continued actively. The longest three-hinged steel arch, 750 ft. in span, was completed over Croton Lake in Westchester County, N. Y. Seattle contributed a notable deck truss cantilever of 800-ft. main span in its Lake Union bridge. The largest state bridge-building program was that of Kentucky, which virtually completed about a dozen of its toll structures over the Ohio, Tennessee, Kentucky and Cumberland rivers. The largest structures spanned the Ohio River and, with the exception of the 1,060-ft. suspension bridge at Maysville, are of cantilever type with main spans from 600 to 750 ft. long.

The largest current developments center around San Francisco Bay. The 4,200-ft. span Golden Gate suspension bridge, although ready to go ahead and actually with contracts let, is still delayed by litigation. The Trans-Bay crossing between San Francisco and Oakland is in the active planning stage, with a design office established by the California state highway commission in San Francisco. The 10,000-ft. water barrier which the bridge must cross will require an unprecedented structure; model studies and calculations have been made for a multiple-span suspension bridge with an anchorage at each end and for two independent suspension bridges with a common anchorage at the center of the channel.

Financial, legal and political difficulties also arose to plague two other important projects as they did the Golden Gate bridge. The much-discussed highway and railway bridge over the Mississippi at New Orleans advanced to the stage of taking bids only to have a Louisiana gubernatorial controversy make state bond selling impossible. The second project, held up because of political injunction proceedings, involves the two 1,000-ft. Shelter Island suspension bridges on Long Island in New York.

Several notable structures were built in foreign lands. First on this list is the Sydney Harbor bridge, a steel arch greater in almost every respect than the record-breaking Kill van Kull arch in New York, except that its span of 1,650 ft. is 2 ft. shorter than the New York bridge. The Sydney Harbor bridge is practically completed.

Buildings

WITH reduced volume of work the building field did not make an outstanding impression. Yet some noteworthy developments occurred. Large office-building construction is almost at a standstill. The largest current project is the Radio City development in New York, a group-planning enterprise covering three city blocks and involving one 68-story building with 2,000,000 sq.ft. of rentable space, four other office structures from 30 to 45 stories high and several large theaters. Work is in progress on the 44-story Field Building in Chicago, destined to be that city's largest office structure. On the other hand, public buildings such as post offices are being actively prosecuted in many cities, notably St. Paul, Boston, Pittsburgh and Chicago, the structure in the latter city being 800x350 ft. in plan and 200 ft. high. In Washington, D. C., work continues on the federal government's extensive building program. The Commerce building was completed, the similar Labor building is under way, and the new House office building as well as the monumental structure to house the Supreme Court are being erected, among others.

During the year a new class of building came into prominence—namely, the combination railroad freight terminal and distribution center first introduced several years ago by the Furniture Mart and the Merchandise Mart buildings in Chicago. In New York this type of structure was exemplified by the Starrett-Lehigh Building, which was completed, and the Inland Freight Terminal of the Port of New York Authority, construction of which was begun. The St. Louis Mart building was placed under construction, as was the new Union Pacific Terminal building at Los Angeles.

Industrial building work was even less active than office building, but one interesting structure was completed at the Pittsfield plant of the General Electric Co., which involved an entirely welded frame with the walls from ground to roof filled in with glass in steel sash. In contrast to this was the windowless factory building of the Simonds Saw Co., at Fitchburg, Mass., in which elaborate artificial lighting and ventilation facilities were installed.

Structural Advance

DEVELOPMENTS that mark new or extended uses of engineering materials have been normally conspicuous and appear to be increasing in importance. One of the most important was the virtual standardization of wide-flange rolled steel shapes by the two principal mills. High-early-strength portland cement enjoyed increasing utilization during the year, particularly in roads and bridges. Reinforced brickwork, with which the industry has been experimenting for several years, emerged from the laboratory stage, a spur track railway trestle and a 42-ft. span arch bridge being among the structures built with this material.

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Promotion of steel floors continued on a wide front; activity was more pronounced in the field of buildings than of bridges. Whereas the flat steel-plate floor has previously ruled this new field, the past year saw the introduction of patented floors using special pressed steel shapes and assemblies of standard structural sections. Gypsum floors played an important part in permitting an increase in height of several buildings, notably the Girard Trust Building in Philadelphia and the Maurice L. Rothschild Building in Chicago. In respect to wind design of high buildings, deflection and vibration have emerged as important considerations, but without definite knowledge of how to cope with them. Observations are in progress on the Empire State Building in New York, and wind-tunnel measurements of pressure on a model of the building are being made by the Bureau of Standards.

In the field of bridges the greatest advance was represented by the completion of the Hudson River bridge, in which Ammann's theory of a virtually unstiffened system for long-span suspension bridges found its first successful expression. Prestressed shop-manufactured twisted-wire strands for cables were produced by two wire mills and used in three suspension bridges with main spans of over 1,000 ft. Rolled girder-beams of 30- and 36-in. depth were used more extensively. Model analysis received important impetus in bridge and dam studies.

Aluminum structural shapes were used more widely, a notable installaton having been fabricated for the dome of the conservatory in Washington. Aluminum overhead traveling cranes, aluminum booms for power shovels and aluminum railway cars were built during the year.

Welding

STRUCTURAL welding, while not enjoying the wide utilization of 1929-1930, intrenched itself more firmly as an acceptable method of steel jointing. The report of the structural steel welding committee gave designers their first firm foundation of welding facts. A welded joint carrying 380 tons was used in the Du Pont Building in Wilmington, Del. On a building at Lynchburg, Va., a welded erection seat that eliminated the need for field bolts was successfully used. Attention during the year has been directed toward methods of weld inspection and test, with some notable contributions in the field of nondestructive testing, including the use of magnetic instruments, the stethoscope and gamma and X-rays. During the year 21 cities incorporated provisions for welding in their building codes, making a total of 114 municipalities that have taken such action; New Orleans is the largest of these cities, followed by Dallas, Tex. A new technique of oxyacetylene pipe-line welding utilizing a carburizing flume to heat the base metal has enjoyed considerable success and speeded up production in the field.

Waterways

WATERWAYS are receiving unusual attention. A resurvey of the Nicaragua Canal route, authorized in 1929, has been completed; an adverse report was submitted to Congress in December, stating that the Panama Canal is operating far below its present capacity, which capacity can be increased greatly by an added set of locks and increased water supply. The first step in increasing the water supply had by that time been taken, the contract for the construction of Madden Dam at the headwaters of the Chagres River having been let in September. In November floods and landslides caused the closing of the Panama Canal for about three days, though no serious damage resulted.

With the Illinois Waterway approaching completion under federal control, it has been proposed to connect it with Lake Michigan by widening and deepening the Sag Canal and Calumet River, thus avoiding the Chicago River. This would involve great expense, since the route traverses a busy industrial section and intersects many railways.

Completion of the deepening of the Hudson River to Albany and the opening of Albany's marine terminal to ocean-going vessels marked the most notable advance of the year in inland water transportation. Deepening of the Mississippi from the mouth of the Ohio to Minneapolis to provide a minimum depth of 9 ft. and the deepening of the Missouri River from its mouth to Kansas City to provide a depth of 6 ft. have been carried forward during the year.

Legislation paving the way for the federal government to take over the New York State Barge Canal passed Congress, but with such limitation as to make the plan unacceptable to New York State. Negotiation of a treaty with Canada for the St. Lawrence Ship Canal was resumed during 1931; no definite progress has been announced.

Power

NEW YORK State's plans for the development of its share of the St. Lawrence power made as much progress as could be expected in the absence of an international treaty. Elsewhere hydro-electric power development planning lagged, due to sharp falling off in power demand. However, the aggregate of all the plants completed or under construction during the year, including both this country and Canada, will be well over 1,000,000 hp. These plants generally are the result of plans developed before the depression. In turbine development the increasing use of propeller-type runners with adjustable blades is notable.

Water Supply and Purification

THE results of inadequate long-time planning have never been so clearly evidenced as during the droughts of the past two years. Last summer even Chicago, with an inexhaustible water supply washing its border, was on a ration basis for a short time, a happening which again emphasizes the need for early action on waste prevention. Decisions of the U. S. Supreme Court in the Connecticut and Delaware river cases on utilization of interstate waters clarified almost age-old controversies as to states' rights and limited the riparian claim that natural flow must not be disturbed.

For two consecutive years the logical planning that characterized the waterworks industry has suffered from unexpected events. During 1930 the drought showed many supplies inadequate. Then, in 1931 the sharp curtailment in consumption growing out of reduced industrial activity caused financial embarrassment to some works and made some new plants appear overbuilt, that of Detroit, for example. Cleveland's program of new construction has been largely deferred because of the decreased consumption. But these very conditions also carry a warning. When the consumption curve returns

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to its normal position there may not be time to make needed extensions in those communities which now are deferring them because of low demand.

A year ago taste-elimination treatment emerged from the research laboratories. Waterworks designers and operators have since then widely adopted it. Specific fields of application have been developed for each of the taste-and-odor treatments now in use.

Garbage

JUDICIAL action in 1931 quickened engineering attention to the problems of garbage and refuse disposal. The practice of dumping at sea received a death blow when the U. S. Supreme Court ordered New York to discontinue disposing of its garbage in this manner because it was being stranded on New Jersey beaches. In consequence New York is now engaged in the largest program of incinerator construction the country has yet seen. Significant emphasis was also given to this phase of municipal engineering by the federal comptroller general, who held that the bids received for the construction of an incinerator plant for the District of Columbia were void because they were not made on a common basis of design and therefore not properly competitive. The bids had been received from a number of incinerator manufacturers, each basing his estimate of cost on his own plant design. In accordance with the ruling a firm of consulting engineers was engaged to design the plant, and competitive bids for its construction were then called for from general contractors.

Sewage Treatment

NOTABLE progress as well as some notable delays affect the plans for treating the sewage of the larger cities. The first step was taken in New York's treatment program when construction was started on the Wards Island activated-sludge plant. Cleveland let the first contracts for its Easterly plant, also of the activated-sludge type. Toledo put its new plant into commission. In the Twin Cities the long overdue sewage plant has been delayed indefinitely by disagreement on costs between the three communities involved. Plans for a new plant at Columbus, Ohio, are held up by a court decision that hampers financing.

The use of two-story settling tanks is declining, and mechanical equipment is increasing. In all the larger complete-treatment plants now under construction oxidation is effected by the activated-sludge method. Where settling only is provided, separate sludge digestion is employed. Both processes require or encourage the use of mechanical equipment for sewage aeration, for sludge concentration, agitation and dewatering, and for utilizing the heat of the gas evolved during digestion. These newer treatment methods are favored by the better control they allow over the biological processes involved.

Sludge disposal remains a wide-open field for investigators, especially because of the intractable sludge produced in large quantities by the activated-sludge process. Columbus is carrying on a series of tests on vacuum filtration; if they are economically successful, mechanical dewatering may supplant the space-consuming sand drying bed.

An immense additional amount of sewage under treatment and many improvements in important details are the promise of the day.

Regional Engineering

PHILADELPHIA and New York completed plans for their respective metropolitan districts in recent months, and the planning organizations are being refinanced for the difficult work of educating the officials and people to make their plans realities. On the other hand the Chicago association continues on its course of developing and realizing a plan piecemeal. It is now beginning to see the state and country highway systems extended into the city at the expense of state and county funds. St. Paul is in the middle of a five-year construction program, whose continuation has assisted materially in relieving unemployment. Kansas City is at the beginning of a heavy program. All plans this year have to run the gantlet of stern necessity.

Highways

TOTAL expenditures for highway improvement were somewhat greater in 1931 than in any previous year. The increase was due to exceptionally large expenditures on federal-aid and state highways, while county and township work decreased. New construction of state and federal-aid roads in 1931 exceeded that of 1930 by nearly 10,000 miles, due not only to increased state expenditures but also to large appropriations of federal funds, including an $80,000,000 loan to the states to provide employment by road construction.

Total state and federal-aid system expenditures exceeded a billion dollars and gave employment to an average monthly force of about 270,000 men, and at the peak of the construction season to nearly 400,000 men. As a means of increasing employment, roadbuilding carried on beyond the accelerated activities of the normal construction season by planning extended winter-work programs. A development that further extended roadbuilding as an unemployment-relief measure was the pronounced swing of improvement activities to county and township local roads. A wide movement developed to absorb local roads into county and state systems. The growing interest in local roads increased invention and activity in the development of low-cost roadbuilding materials and methods. In main-road pavement practice the trend of recent years continued toward better alignment and reduced grades and greater refinement in grading and surfacing practices.

Costs of all roadwork showed a decided drop in 1931, partly because of the sharp break in wages and materials prices but also in response to the descending cost trend of recent years due to improved construction machinery and methods. The new year opens with clear indications of less state and federal-aid roadbuilding in the coming season and little hope that counties and townships will increase their highway activities.

Rapid Transit

NEW developments of interest are to be recorded in the field of rapid-transit railway construction. Good progress was made on the Eighth Ave. subway system in New York. Part of it is expected to be put into operation in April, most of the remainder is under contract and much of it is well along toward completion. Further extensions of the Philadelphia and Boston

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systems are under way. At Chicago last year's prospects of a start on subway construction have faded; the whole undertaking is hopelessly tied up in the courts.

Railways

FINANCIAL problems largely eclipsed all other current matters of engineering interest in the railroad field, especially during the latter part of the year. Dilatory tactics on the part of the Interstate Commerce Commission postponed action on the railroad companies' plea for increased rates until the opening of the new year, too late to save some railroads from bankruptcy. Financial prospects have brightened very recently; a 10 per cent wage cut was negotiated with the employees' unions late in January—the most noteworthy agreement between railroad managements and workers in American history.

Despite financial conditions, progressive development in the railroad field has continued; in fact, progress in some directions has been stimulated by the need for more economical operation and the intensity of competition. This is especially notable in the spread of store-door delivery and container-car services and in the increased coordination of rail and motor transport. Nor has there been a cessation of construction and modernization, although much of the work now in hand was contracted for before the dark days in the latter part of 1931.

Among extensive terminal improvements which include grade separation and union stations are those at Cincinnati, Columbus and Dayton, Ohio; Fort Worth, Tex., and Tulsa and Oklahoma City, Okla. An unusual feature in passenger terminals is the new Chicago suburban terminal of the Illinois Central R.R., independent of the main-line terminal station. The Chicago Plan Commission proposes a union station to replace the present four terminals south of the Loop and to serve nearly a score of railroads. At East St. Louis a new union station, somewhat distant from the ancient Relay Station, will necessitate extensive changes in the several railways.

Railway extension has been active in Texas, and important construction includes the Great Northern and Western Pacific connection in Oregon and California. The Rock Island has also completed a direct line to Kansas City, but the Dotsero cutoff to give Denver (and the Denver & Rio Grande Western R.R.) a shorter line to Salt Lake and the Pacific Coast is still in the future.

In track construction, an important improvement is the 152-lb. rail of the Pennsylvania, notable not only for its great height and weight but also for the warped splicebars of the fish-plate type designed to be used with it.

New developments in the way of equipment include the experimental construction of a number of hopper-car bodies of aluminum and the extension of the application of air conditioning to passenger cars, begun by the B. & O. in 1930, to a considerable number of cars on other roads.

Railway electrification work was confined principally to the Pennsylvania work between New York and Washington and the Reading suburban electrification at Philadelphia.

Hydraulic Studies

TWO notable developments in hydraulic studies occurred during the year, the start of work on the National Hydraulic Laboratory in Washington and the opening of the U. S. Waterways Experiment Station at Vicksburg. The latter was authorized by the Mississippi flood-control act to provide the army engineers with a laboratory of a size adequate for river studies. The new laboratory in Washington will be ready for operation late this year. It will fill a long-felt need for a large hydraulic laboratory in this country. Vicksburg has already completed extensive experiments on channels.

Colorado River

THE Hoover Dam contract was let last spring. Construction forces are massed on preliminary stages of river control in Boulder Canyon. The great metropolitan area of southern California has voted to begin at once its gigantic aqueduct project to bring Colorado River water to the Coast—260 miles across mountains and deserts. The All-American Canal, third major element of the Colorado River project and designed to remove international complications from the Imperial Valley irrigation supply, is still in the agreement stage, but rapid progress is probable in 1932.

Mississippi Flood Control

AMAZING progress in prosecuting the physical tasks of the Mississippi River flood-control plan contrasts with the slow development of the litigation that is blocking progress on the essential diversion floodways, and equally slow development of the widely urged modification of the official or Jadwin plan. The litigation that resulted in the injunction which led to cessation of all construction in the Boeuf and the Atchafalaya floodways was appealed to the U. S. Supreme Court late in 1931; it should be decided soon. Meanwhile the Chief of Engineers had presented a voluminous report reviewing the adopted plan, as requested by the congressional committee on flood control, in which he reaffirmed the soundness of the present plan with qualifications that left open certain details for further study and recommendation. While awaiting this report Congress had little opportunity for action, and thus the plans for flood control still remain exactly where they were a year ago, with opposing interests lined up for battle in Congress.

High Dams

TWO dams now under construction will each surpass the previous record holder by a large margin. In eastern Oregon the Owyhee Dam, a concrete gravity-arch structure 530 ft. high above the lowest foundation, is nearing completion. It exceeds the Diablo Dam on the Skagit River by a round hundred feet. But within a few years it will in turn be overtopped by the Hoover Dam, 200 ft. higher.

Height increase has properly led to greatly intensified study of design questions. Foundation strength and tightness, stress distribution within the dam, effects of shrinkage due to cooling from the setting temperature of the concrete, are under new investigation, by analysis or experiment or both. Several new design forms have been proposed; original thinking in the field of dams is more active than ever before. Stress analysis by the trial load method, the highest development yet attained in dam calculation, is being subjected to model-test check in two elaborate investigations, one by the U. S. Bureau of Reclamation on concrete models, the other by the

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Aluminum Company of America on rubber models. Even more extensive test studies are in progress by the Bureau of Reclamation to measure shrinkage stresses and to develop a cement of low setting heat for use in the Hoover Dam, in order to minimize shrinkage stresses, joint opening and cracking.

An increasing tendency to the use of dry concrete mixtures and to assuring solidity by vibrating the concrete in place is to be recorded. Care in mixture control is increasing, the most elaborate development being an automatic weighing-scale system with mechanically indicated moisture equalization, first used at the Koon Dam near Cumberland, Md.

Professional

SUPERFICIAL distinctions disappear in times of great stress. This is true in professional life as elsewhere. Those who feared that the profession was breaking down into a number of unrelated groups had their fears largely dispelled during recent months by the unmistakable evidence of the fundamental solidarity of the profession that developed in those centers where unemployment among engineers had reached a critical stage. All group distinction vanished in the movement to provide the maximum amount of relief to the men out of work.

Further spread of the registration of engineers is to be recorded, as well as advance in the movement to improve existing registration laws and to develop greater uniformity in the fundamental requirements of those laws. Society activities have been checked somewhat by reduction of income. The individual member also has been unable to take as active a part as normally. Some meetings have therefore been shortened or canceled; the spring meeting of the American Society of Civil Engineers is being omitted this year.

Construction Equipment

AS CONSTRUCTION and equipment advance go hand in hand it is gratifying to note that even during the past year construction equipment has done its share in advancing the art of building. Bituminous highway construction is responsible for much of the new and improved equipment brought forth the past season. This type of work is becoming highly mechanized, from the mixing and spreading operations on through the finishing stages. Every operation, many of which were formerly considered as hand jobs only, can now be performed by machine. The latest development is a single machine that performs all these operations. The concrete field, both roadbuilding and general, has also received attention. Truck mixers on road work call for new concrete distribution equipment. Aggregate proportioning is becoming more scientific, made possible by the continued improvement of weighing and measuring devices. Increasing use of bulk cement has called for the necessary equipment to handle this commodity. As construction becomes more and more motorized, the truck manufacturers are turning out special models adapted to the peculiar needs of the field. On the Mississippi levee work larger and heavier dirt-moving machines are producing more yardage. An outstanding development in this field is the 175-ft. duralumin boom for draglines and cranes, which permits much wider range of operation. In the development of all construction equipment there is a noticeable tendency toward easier handling and operation, a real consideration for the operator. Motor control of the heavier pieces of equipment is becoming common. The increased use of lighter and stronger alloys, welded construction and frictionless bearings continues in every line of machinery.

Pipe Lines

PIPE-LINE work formed one of the bright spots in 1931 construction. While fewer new projects were initiated than in some previous years, the aggregate mileage completed was exceeded only by the 1930 record. Over 15,000 miles of trunk pipe lines for gas, oil and gasoline were laid, which with the feeder lines accounted for expenditures in excess of $400,000,000. This mileage represented 7,700 miles of gas, 4,200 miles of oil and 3,400 miles of gasoline lines. Seventy-five per cent of the total expenditure was for gas pipe lines. Gasoline line construction presented the most interesting development. This class of work may soon dominate the pipe-line building field.

Air Transport

AIR transport, despite continued deflation in the aeronautic industry as a whole, recorded gains over 1930 in number of passengers and tons of mail, freight and express carried. Air-express operations constituted a particularly bright spot. Commercial plane production was at a standstill, but government orders for army and navy machines reached 23 million dollars. Among the technical achievements of the year were the completion of the airship "Akron" and the start of work on its sister ship, the "ZRS-5," the placing in service of a 40-passenger amphibian plane, and the increasing use of the autogiro. Stainless steel was used in several planes; its extensive utilization is said only to await the development of suitable welding equipment. The wind tunnel at Langley Field, Va., in which planes of as much as 45-ft. span may be tested, was placed in operation.

New flying records were set up: around the world, 15,474 miles, in 8 days, 15 hours and 51 minutes; across the United States in 11 hours, 16 minutes; non-stop from Japan to Seattle, 4,588 miles, in 41 hours and 13 minutes; and a new non-stop distance flight from New York to Turkey, 5,011 miles. The "Graf Zeppelin" continued its successful cruising, making three trips to Brazil on the projected transatlantic mail route and one to the Arctic. While Germany and the United States continued to exploit the lighter-than-air form of transportation, Great Britain, sobered by the disaster to its "R-101," sold the "R-100" for scrap, thus turning its back on the airship.

Airport development was on a more sane if less active scale during 1931 than for several years preceding. By and large, operating development took precedence over new construction, although 171 new commercial and 107 municipal fields were added, bringing the total in the United States to 675 commercial and 656 municipal. Randolph Field at San Antonio, Tex., the $25,000,000 air corps training center, headed the list of large projects completed during the year. A large commercial port was built at East Hartford, Conn., and Birmingham, Ala., Shreveport, La., and New York City completed notable municipal projects. Work was begun on the lighter-than-air base at Sunnyvale, Calif., which will include a hangar for the large navy ships.

Facts and Figures of Current Construction Progress

Volumes and costs show considerable decrease—Materials production lower, with some drop in prices—Labor wages affected by unemployment—Budgets and estimates indicate further loss for present year

PREDICTIONS MADE twelve months ago of a construction year in 1931 equal to that of 1930 failed to materialize, despite a heavy increase in public works and rapidly decreasing construction costs. The 1931 volume was about two-thirds of that of the peak years 1927 to 1929.

However, in looking over a decade of construction, 1931 compares favorably with that of 1924.

Construction costs dropped considerably during the year. The *ENR* cost index averaged 181.35 for the year but closed at 162.48, the lowest monthly average since March, 1922. Materials prices varied, some holding steady, others breaking sharply. Construction wages, reacting to serious unemployment construction was almost non-existent.

Money for construction became tight during the closing months of the year. Public bond sales became stagnant the last quarter, while private capital for construction was almost non-existent.

The 1932 outlook is for a slightly decreased construction volume compared with 1931.

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Construction Volume Declined Despite Increased Public Works; Costs Also Lower

PUBLIC works construction, boosted by a 242 per cent increase in federal government activity, showed a slight increase in 1931 over 1930, but failed by far to compensate for nearly a 50-per cent slump in private construction, throwing the total engineering construction for the year to 78 per cent of the previous year. Residential building was but two-thirds of that of 1930. Non-residential building was barely half that of 1930, and public utilities, excepting telephone companies, spent much less than in the previous year. The dollar value of all construction in the United States fell from the 1930 mark of nearly 8 billion dollars to slightly over 6 billions in 1931. This is in line with the steady decrease prevailing since the 10-billion dollar peak of 1928.

Although the peak of all construction was reached in 1928, the trend of the component parts of construction varied somewhat during the past eleven years. Residential building rose sharply during the early years of the past decade, maintaining a level from 1925 through 1928 of three times the 1931 figure, then dropping off to two-thirds the 1921 volume in 1931. Non-residential building followed the same trend, but with a lesser spread. Federal construction figures for the period show no definite trend, but 1931 was a high mark for all time. Highway construction reached a maximum in 1930, while other public work has been dropping slowly since 1927. Construction in the railroad field was highest for the decade in 1927. Power development was at its height in 1930, as far as construction is concerned.

Every part of the country suffered alike in the loss of construction volume in 1931. Distributing the total construction for the year among six geographical divisions shows that each division accounted for almost the same proportion of the total work in 1931 as in 1930. The South and the West fared better in loss of volume, on a percentage basis, than did the remainder of the country.

Three classes show gain

In contracts reported there were but three classes of construction showing a gain in 1931 over 1930. Waterworks contracts reached 119 per cent of the previous year, public bridge construction was about 13 per cent ahead of 1930 and federal work showed a gain of 142 per cent. Sewer contracts did not

TABLE I — ALL CONSTRUCTION AND THE PRINCIPAL COMPONENTS
(Millions of Dollars)

	Building		Public Works			Public Utility				
Year	Res.	Non-Res.	Federal	Roads	Municipal	RR	Power	Tel. & Tel.	Elec. Rys.	Gas
1921	1,100	1,275	421	627	462	765	222	180	100	...
1922	1,675	1,800	325	560	895	736	324	185	113	...
1923	1,980	1,700	243	518	1,534	822	602	250	102	...
1924	2,120	1,920	310	637	1,553	803	692	288	73	...
1925	3,000	2,550	309	652	1,635	824	721	258	58	...
1926	2,910	2,800	274	617	1,946	878	841	258	59	...
1927	2,800	2,680	290	689	2,509	880	760	231	81	...
1928	3,020	2,730	304	819	2,499	846	787	262	97	...
1929	2,080	2,820	352	814	1,955	863	866	395	90	...
1930	1,200	2,150	285	1,010	1,956	713	961	372	91	408
1931	885	1,220	446	800	1,900	550	633	390	75	300

TABLE II—DOLLAR VALUE OF CONSTRUCTION
(In Millions of Dollars)

	Residential	Public Works	Other	Total	*ENR* Cost Index
1919	1,160	1,640	740	3,540	198.42
1920	706	1,470	1,204	3,380	251.28
1921	1,100	1,510	860	3,470	201.81
1922	1,675	1,780	1,445	4,900	174.45
1923	1,980	2,300	1,590	5,870	214.07
1924	2,120	2,500	1,610	6,230	215.36
1925	3,000	2,594	2,806	8,400	206.68
1926	2,910	2,847	2,943	8,700	208.03
1927	2,800	3,488	2,872	9,160	206.24
1928	3,020	3,622	3,358	10,000	206.78
1929	2,080	3,121	3,929	9,130	207.02
1930	1,200	3,139	3,461	7,800	202.85
1931	885	3,150	2,092	6,127	181.35

TABLE III—VALUE OF CONSTRUCTION BASED ON 1913 COSTS
(In Millions of Dollars)

	Residential	Public Works	Other	Total
1919	585	825	373	1,783
1920	281	586	480	1,347
1921	547	750	427	1,724
1922	960	1,020	830	2,800
1923	925	1,072	743	2,740
1924	987	1,160	743	2,890
1925	1,450	1,250	1,350	4,050
1926	1,400	1,370	1,360	4,130
1927	1,360	1,690	1,380	4,430
1928	1,460	1,765	1,620	4,830
1929	1,000	1,510	1,900	4,400
1930	580	1,545	1,705	3,840
1931	488	1,735	1,150	3,373

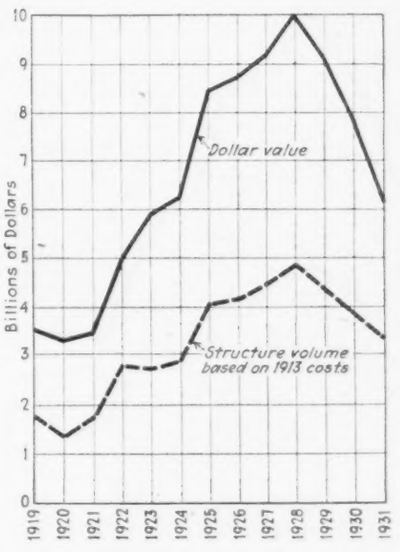


Fig. 1—1931 construction value and volume were in line with the steady decline falling from the 1928 peak. The lower line of this chart represents the absolute value of construction based on 1913 costs, obtained by dividing the dollar value by the *ENR* cost index. The decline in the cost index keeps the absolute value from dropping as fast as the dollar value.

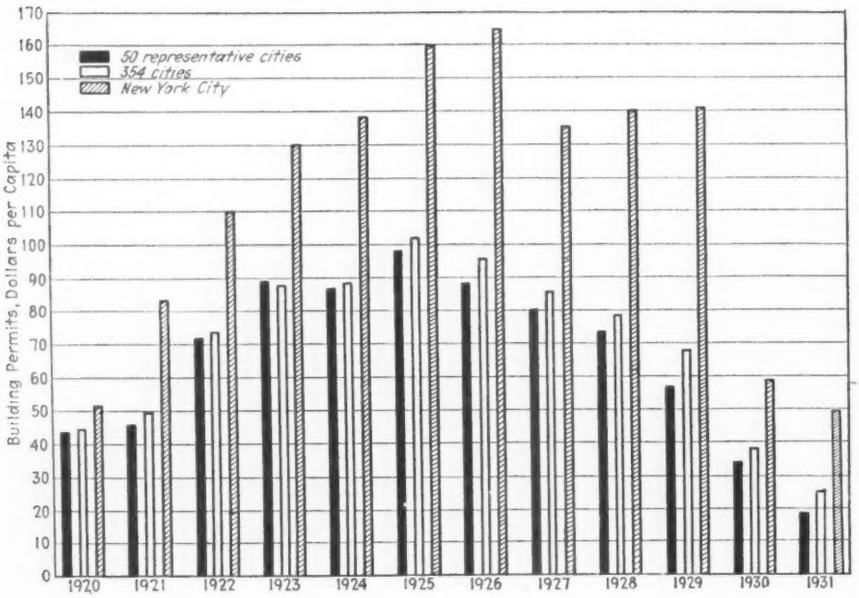


Fig. 2—New York City sets the pace in per capita expenditures for building. The peak in this city's building was reached in 1926, one year later than that for the entire country.

follow the waterworks trend, but dropped off to 88 per cent of the 1930 volume. Streets and roads contracts fell off about 8 per cent. Private building and bridge contracts were less than 60 per cent of the previous year's volume.

Building permits

For the first time we are publishing building permit figures for the country. These figures tell the story of what has happened in the residential and private building field over an eleven-year period. There are 354 cities reporting building permits. From this list a selection of 50 was made, ten over 500,000 population, twenty between 100,000 and 500,000 population, and twenty under 100,000 population, well distributed geographically, to use as a basis for future constant use. To estimate the building permits for the entire country, the average per capita building expenditures for the 50 cities for each year was plotted against the urban population of the entire country, the population increase from 1920 to 1930 being considered as constant.

The peak of building construction, according to the permit figures, was reached in 1925. From 1920 to 1925 the rise in permits almost exactly equalled the fall from 1925 to 1930. In 1931 the figures fell to the lowest point of the eleven-year period. In 1925 all permits reported totalled slightly less than 4 billion dollars, but the estimate for the entire country that year reached 6 billions. This is a rise from an estimated total of 2,400 million dollars in 1920. The total estimate for the last year is 1,300 millions, with a total of 1,212 million dollars actually reported by 354 cities.

New York permits high

The place New York City occupies in the building field is clearly shown by its permit figures. At the 1925 peak, New York alone accounted for one-sixth of the estimated total for the country. However, building in New York did not reach its peak until 1926,

Fig. 3—Building permits tell the story in the private building and residential field. 1925 saw the peak in this type of construction, in contrast to the total of all construction, which steadily increased until 1928. Out of 354 cities reporting building-permit figures, the 50 listed in Table V were selected as a basis for future comparisons. The average per capita expenditures of these 50 cities was plotted against the total urban population of the nation to get the estimated total of building expenditures for the entire country, which, in 1925, reached the staggering figure of $6,000,000,000.

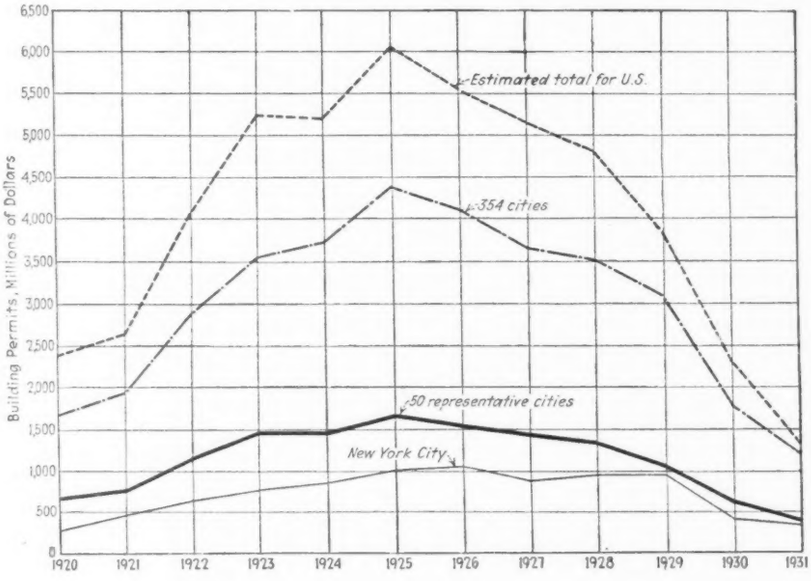


TABLE IV—ENGINEERING CONSTRUCTION CONTRACTS REPORTED IN 1931

(Thousands of Dollars)

	New England	Middle Atlantic	South	Middle West	West of Miss. River	Far West	Total United States 1931	Total United States 1930	Total Canada 1931	Total Canada 1930
Waterworks	8,637	12,917	3,356	8,440	8,750	14,263	56,413	48,558	8,066	8,601
Sewers	3,133	27,026	4,856	24,903	6,831	6,065	72,814	82,189	7,172	7,254
Bridges, public	3,461	30,788	20,119	23,223	18,044	30,069	20,638	109,390	4,928	8,558
Excavation, public	1,970	3,308	2,959	6,688	3,882	1,831	125,704	34,376	3,078	7,629
Streets and roads	32,283	119,375	98,576	89,012	135,621	53,645	528,512	576,993	26,376	20,652
Federal government	16,488	52,328	51,377	40,219	42,093	78,455	280,960	116,445	26	.....
Unclassified, public	9,841	54,300	2,572	8,763	3,176	5,713	84,365	123,552	17,923	27,819
Buildings public	38,015	114,557	11,371	43,957	21,438	19,428	248,766	297,719	7,909	18,558
Total public	113,878	414,599	195,186	245,205	239,835	209,469	1,418,172	1,389,222	75,478	99,071
Buildings, industrial	14,584	66,359	10,445	27,930	19,336	27,096	165,750	331,171	30,732	39,021
Buildings, commercial	49,791	371,478	8,157	72,880	30,141	28,203	560,650	1,033,672	15,785	31,845
Bridges, private	117	1,060	4,786	4,060	836	325	11,184	20,183	677	208
Unclassified, private	7,246	115,482	15,626	29,876	106,104	24,086	298,420	399,011	7,144	17,561
Total private	71,738	554,379	39,014	134,746	156,417	79,710	1,036,004	1,784,037	53,338	88,635
1931 total	185,616	968,978	234,200	379,951	396,252	289,179	2,454,176	.....	129,816	.....
1930 total	265,264	1,288,248	270,217	533,733	490,014	325,793	.....	3,173,259	.....	187,706

with a total of 1,053 million dollars. This figure dropped slightly in 1927, but approached the billion mark again in 1928 and 1929, when the New York permits amounted to 24 per cent of the country's total. In 1930 a drop of 50 per cent occurred in New York's permits, with a slightly further loss in 1931. However, the 1931 New York building figures, totalling $350,000,000, amounted to 27 per cent of the estimated total for the country. In 1931 building permits in New York reached within $11,000,000 of the total reported by our 50 representative cities, with a population three times as great. In 1926 the building permit figures of New York amounted to $164 per capita against an average of $87.80 per capita for the 50 cities.

Costs down

While construction volume has been decreasing since 1928, costs did not break until the middle of 1930. They then held steady for six months, and early in 1931 started to fall, dropping to an average for the year of 10.6 per cent below the 1930 average, according to the *ENR* construction cost index. The index closed the year at 162.48. Reducing the dollar value of construction to an absolute volume based on 1913 costs, by dividing by the *ENR* index, shows this figure for 1931 as 3,373 million dollars, compared to 3,840 millions for 1930. The Tilghman Moyer cost index of a bank building and the Aberthaw index of a typical reinforced concrete building follow the *ENR* index in the decline of the past two years.

Ordinarily cost indices are a fairly true gage of construction costs, but during the past year costs tumbled in a

TABLE V—BUILDING PERMITS (THOUSANDS OF DOLLARS)

	Pop. (1930) Thousands	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931
1 Chicago	3,376	76,173	125,005	227,742	329,604	296,894	360,804	364,584	352,936	315,800	202,287	79,613	46,444
2 Philadelphia	1,951	55,305	42,791	114,881	122,651	141,737	170,914	140,267	117,221	111,805	106,229	55,267	35,126
3 Detroit	1,569	77,737	55,635	94,615	129,720	160,065	180,133	183,721	145,556	129,260	100,542	48,369	23,068
4 Los Angeles	1,238	60,024	82,761	121,207	200,133	150,148	152,636	123,006	123,027	101,679	93,016	74,089	41,211
5 Cleveland	900	65,626	46,531	55,148	69,391	63,015	69,254	61,777	45,481	54,592	37,783	32,440	11,962
6 St. Louis	822	17,694	16,631	25,211	41,444	39,832	54,877	39,842	42,075	42,813	27,331	17,348	16,620
7 Boston	781	28,167	24,049	57,497	40,676	53,032	70,718	51,484	56,809	55,445	51,223	24,883	24,680
8 Pittsburgh	670	16,048	23,430	35,255	32,929	34,157	41,512	43,790	37,139	40,254	36,175	20,759	13,062
9 Milwaukee	578	14,913	19,417	25,250	41,441	45,634	39,584	41,210	46,361	45,589	46,657	32,335	12,174
10 Buffalo	573	13,121	18,642	25,891	27,907	28,499	26,774	27,407	33,076	24,516	24,182	17,303	7,805
11 Minneapolis	464	13,470	23,392	29,470	32,316	23,247	29,446	20,609	22,430	23,258	20,960	13,449	1,248
12 New Orleans	459	12,598	8,043	10,459	13,089	16,991	16,345	18,789	16,118	11,879	11,975	6,183	5,545
13 Newark	442	20,577	20,771	28,585	35,507	42,484	40,996	45,060	52,633	36,246	30,539	10,199	6,291
14 Kansas City	400	13,760	16,025	23,146	24,844	21,860	38,383	23,117	15,209	15,827	15,469	15,942	5,721
15 Seattle	366	13,760	12,862	19,784	22,975	27,280	30,627	34,208	29,070	34,813	29,105	30,843	9,416
16 Indianapolis	364	15,284	16,872	26,110	27,144	25,453	26,225	21,505	22,775	23,669	15,608	8,135	9,033
17 Louisville	308	8,622	7,428	16,737	17,025	22,683	29,910	20,920	23,243	18,082	13,428	6,846	5,466
18 Portland, Ore	302	12,089	17,226	20,940	25,247	29,219	38,476	32,589	28,973	21,276	15,493	12,064	5,978
19 Houston	292	8,529	10,399	12,489	19,117	17,222	35,040	28,513	27,326	35,320	29,527	17,265	11,900
20 Denver	288	7,547	10,137	18,016	20,642	26,310	25,333	14,591	15,903	15,958	16,634	8,007	7,127
21 Atlanta	270	13,373	11,237	20,585	27,095	18,196	10,404	17,789	12,081	27,581	13,213	8,924	3,402
22 Birmingham	260	4,384	6,556	7,491	12,167	20,248	21,465	22,263	22,862	18,641	10,401	3,186	2,314
23 Memphis	253	6,715	9,377	20,883	20,998	23,757	18,668	18,579	15,095	15,452	8,216	9,921	3,480
24 Omaha	214	11,436	11,385	11,243	13,009	12,269	14,625	10,052	4,522	9,050	5,554	5,036	3,915
25 Oklahoma City	185	6,008	7,795	7,698	7,949	8,053	6,752	10,028	16,239	18,129	24,374	20,605	13,356
26 Richmond	183	4,779	9,293	15,117	15,642	13,613	13,398	10,025	9,781	8,845	9,154	5,896	3,047
27 Hartford	164	20,957	7,827	8,693	9,281	18,824	22,130	16,829	17,799	12,936	16,923	6,459	5,733
28 Springfield, Mass.	150	6,675	5,670	9,078	10,998	13,100	15,002	8,734	8,856	5,977	5,095	5,668	3,693
29 Salt Lake City	140	3,939	3,437	4,351	6,886	5,433	6,603	5,602	4,976	5,361	5,671	4,275	2,014
30 Jacksonville	130	3,466	5,087	5,031	7,537	7,311	14,761	21,394	13,051	7,906	4,824	1,594	1,728
31 Rockford	86	2,432	1,999	3,528	3,751	4,103	6,476	5,538	6,564	5,714	5,086	2,863	615
32 Little Rock	82	3,728	3,621	3,909	3,843	4,331	5,108	5,968	2,994	4,261	3,267	2,126	1,666
33 Shreveport	77	5,717	3,871	6,070	9,467	8,069	5,492	5,422	3,978	4,917	3,458	1,560	811
34 Portland, Me	71	1,392	1,538	3,080	4,529	3,112	2,013	4,245	2,327	2,739	2,133	1,566	871
35 Mobile	68	603	600	1,170	1,149	1,300	1,964	1,778	2,241	3,201	1,644	1,085	17
36 Terre Haute	63	756	2,214	2,222	2,645	2,727	1,481	2,061	1,999	989	863	738	919
37 Davenport	61	1,997	1,698	3,287	3,571	1,910	2,056	1,464	2,299	1,391	2,357	2,452	1,201
38 Augusta, Ga	60	1,874	77	2,398	1,235	1,175	1,536	1,136	1,471	1,487	1,192	765	370
39 Charleston, W. Va.	60	1,920	2,000	3,158	3,825	5,327	2,545	3,091	1,503	2,137	2,096	6,214	879
40 Fresno	53	6,776	3,861	7,496	5,890	1,645	3,093	1,820	2,691	1,771	1,699	1,339	1,029
41 Columbia	52	1,152	1,571	1,584	1,331	1,266	1,555	1,490	1,561	1,627	1,284	1,872	1,096
42 Pueblo	50	739	1,166	1,216	898	1,686	2,342	1,246	1,625	1,468	1,573	537	453
43 Phoenix	48	4,515	1,803	1,815	1,841	1,904	3,106	2,637	5,652	5,999	5,249	3,001	2,125
44 Amarillo	43	.....	.....	.....	1,310	1,551	3,437	16,427	10,492	2,906	1,845	1,843	2,738
45 Montclair, N. J	42	1,100	3,494	4,897	6,871	7,552	6,742	7,330	5,460	4,709	3,668	1,940	1,483
46 Butte	40	227	102	314	671	379	168	350	492	365	539	413	28
47 Mansfield, O	34	1,707	494	966	1,634	2,394	3,120	2,930	1,791	1,302	1,000	718	838
48 Burlington, Vt	25	237	207	394	462	409	1,095	1,148	903	750	843	1,556	456
49 Boise	22	860	550	616	734	717	890	648	1,264	693	971	783	382
50 Cheyenne	17	1,169	685	1,287	1,032	480	505	645	727	1,247	805	636	448
Total 50 cities	19,146	671,677	707,262	1,148,810	1,462,053	1,458,603	1,682,519	1,545,708	1,436,657	1,338,152	1,069,160	636,910	360,984
NEW YORK CITY													
Manhattan	1,867	139,200	144,605	165,196	204,032	286,653	398,391	341,256	290,321	381,377	622,435	198,662	130,631
Bronx	1,265	22,325	75,668	113,182	128,428	133,516	157,601	214,855	172,589	189,825	89,417	56,116	65,399
Brooklyn	2,560	80,931	162,133	211,627	284,215	242,919	258,915	288,869	225,443	202,223	149,343	73,903	75,954
Queens	1,079	42,650	83,134	136,722	156,317	165,400	179,410	192,804	179,624	146,510	87,478	70,044	68,536
Richmond	158	5,723	10,747	11,843	12,565	18,018	13,715	15,441	12,770	17,702	11,419	8,342	8,762
Total Five Boros	6,930	290,829	476,287	638,570	785,557	846,506	1,008,572	1,053,225	880,747	937,637	960,092	407,067	349,282
Total for 354 cities	46,884	1,675,227	1,916,437	2,888,082	3,536,737	3,702,135	4,393,364	4,121,965	3,651,036	3,500,730	3,096,839	1,776,623	1,212,196

chaos of frantic bidding, wage declines, and unsettled materials markets, items not readily reflected in an index.

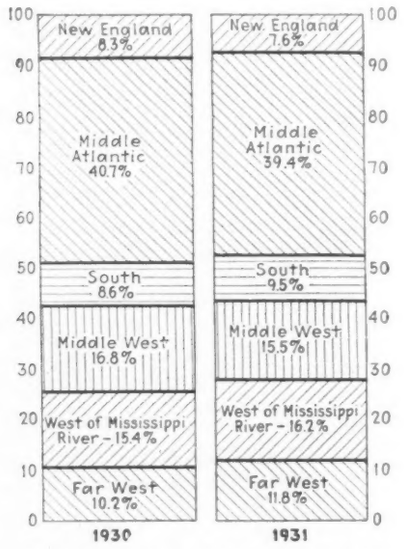
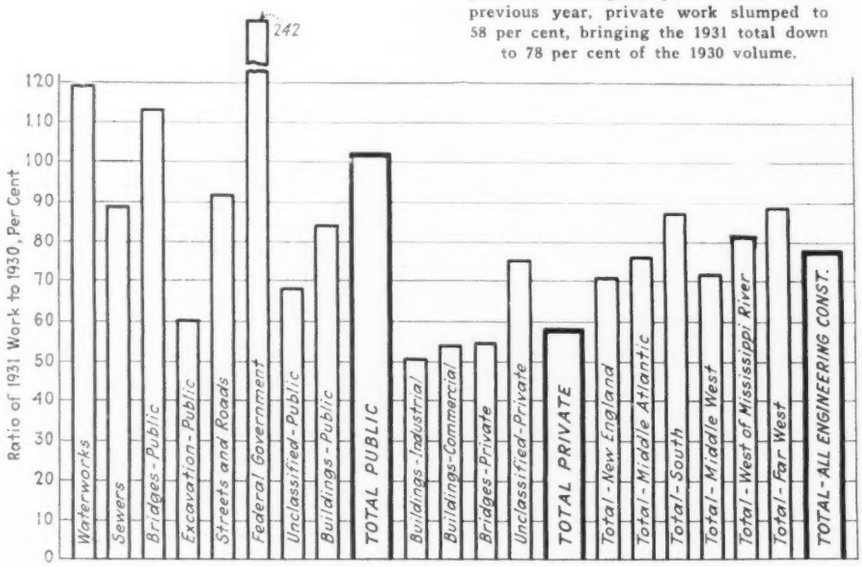


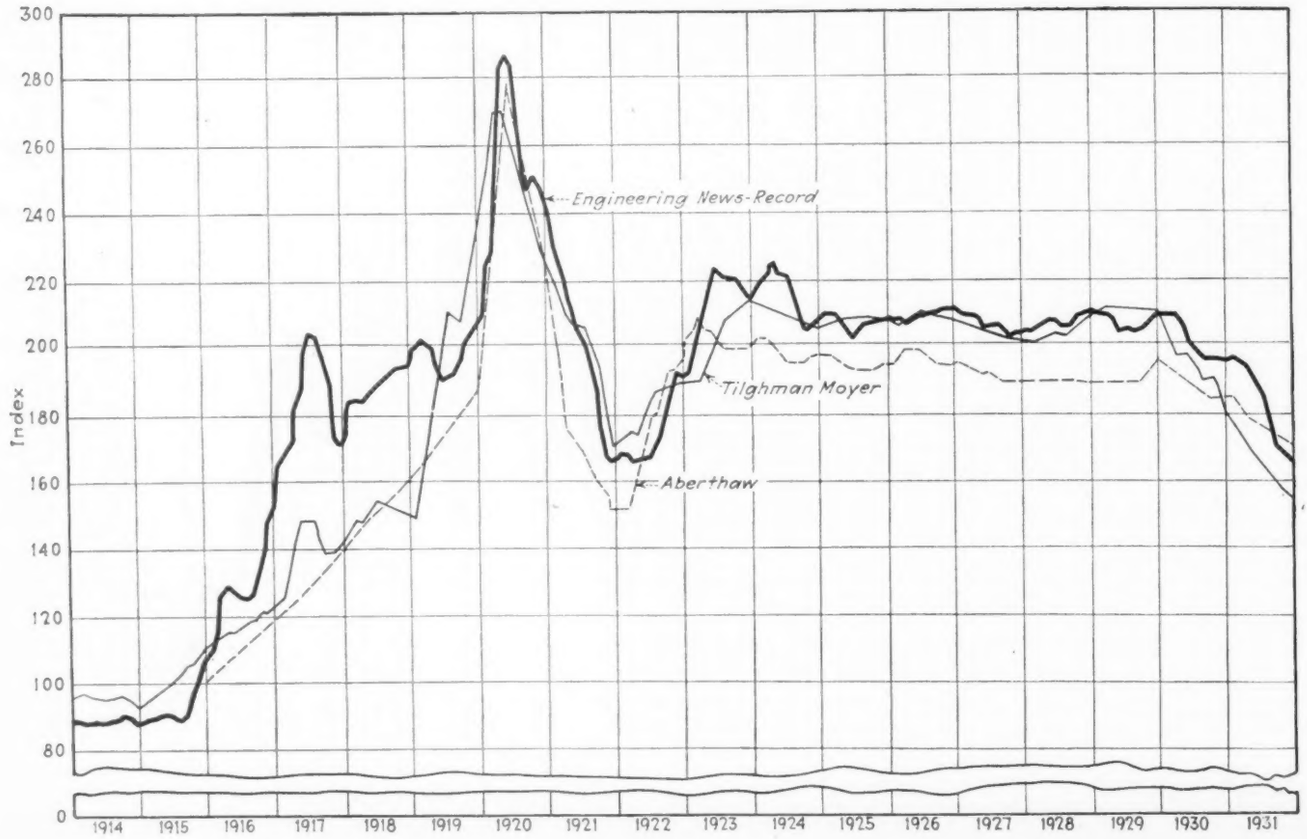
Fig. 4—Contrary to popular belief, the drop in 1931 construction over that of 1930 was spread throughout the country with remarkable uniformity. This chart shows the percentage distribution of total construction for the six geographical regions for the two years.

Fig. 5—Construction costs slumped with the volume in 1931. The *ENR* construction-cost index is compared with the Aberthaw cost index of a typical concrete building and with the Tilghman Moyer cost index of a typical bank building.

Comparison of bids with engineers' estimates in a few cases will illustrate the real drop in construction prices. In 1929 a railroad grade separation project in Binghamton was estimated at $597,000. The work failed to go through at that time, and was re-estimated in 1931 at $434,000. Last July a contract was awarded for the work at a cost of $251,000. During the first ten months of 1931 the New York highway department awarded 293 contracts after receiving bids from 2,439 contractors. The engineers' estimate for the total of these projects was $62,441,000. The contracts totalled $46,272,000. Not one of these contract prices approached the estimate; the savings ranged from 12 to 43 per cent. In December Indiana received proposals for seven projects from 99 bidders. The estimate for all projects was $254,634, yet the contracts totalled only $187,225, a saving of 27 per cent. Similar experiences were repeated many times throughout the country.

Fig. 6—How 1931 engineering construction compared with that of 1930. Though public work slightly passed that of the previous year, private work slumped to 58 per cent, bringing the 1931 total down to 78 per cent of the 1930 volume.





Construction Financing Hampered by Poor Bond Market And Lack of Private Capital

THE past year drop saw a considerable drop in private capital issued for construction purposes, and a slight drop in public bond sales. Private financing fell off from a 1930 total of 4,031 million dollars to 1½ billions in 1931. Public bond sales for the year slightly exceeded 2 billion dolars. Added to the private and bond financing, a $546,000,000 revenue from gas taxes and $446,000,000 from the federal government raises the total of all construction financing to 4,320 million dollars, compared with nearly 7 billions for 1930.

There is a temporary crisis in the public bond situation. Public bond sales totalled 2,038 millions in 1931, a drop of 8 per cent from the 2,163 millions of 1930 when there was a drop of 7 per cent from the peak year 1929. Elections in 1931 totalled $609,000,000 for public securities, and only 22 per cent of this amount was defeated, compared with 35 per cent in 1930 and 41 per cent in 1929.

Statistics however, do not tell the public-bond story this year. The significant event happened in the last three months of 1931 and consisted of a phenomenal decrease in the volume of sales. Following are the figures in millions for the last four months of the last three years:

	1929	1930	1931
September	493	212	104
October	376	116	14
November	129	121	50
December	209	177	16

Fig. 7—Contracts and financing fluctuate approximately together. For the first time in years public contracts and financing have surpassed those of private interests. The new-capital curve is a five-months' moving average of issues carefully selected by Moody's Investors Service as applying to new construction purposes only.

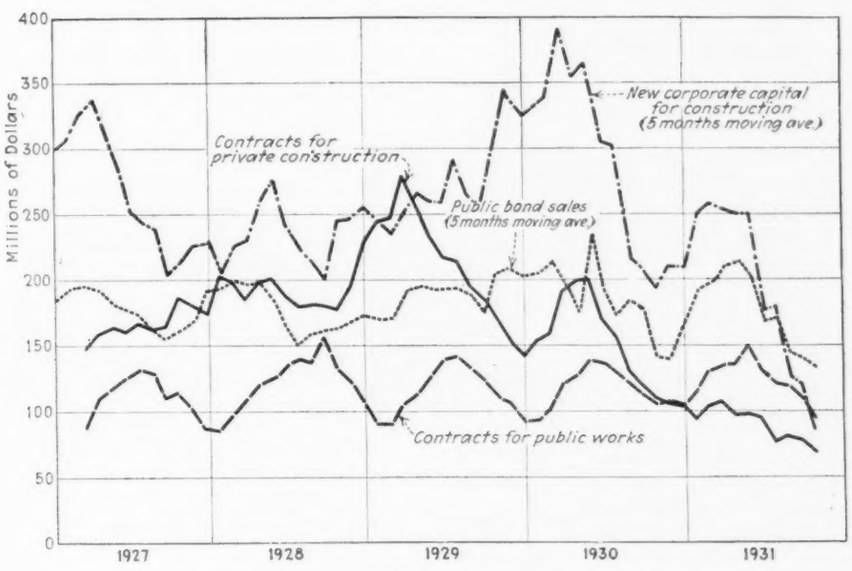
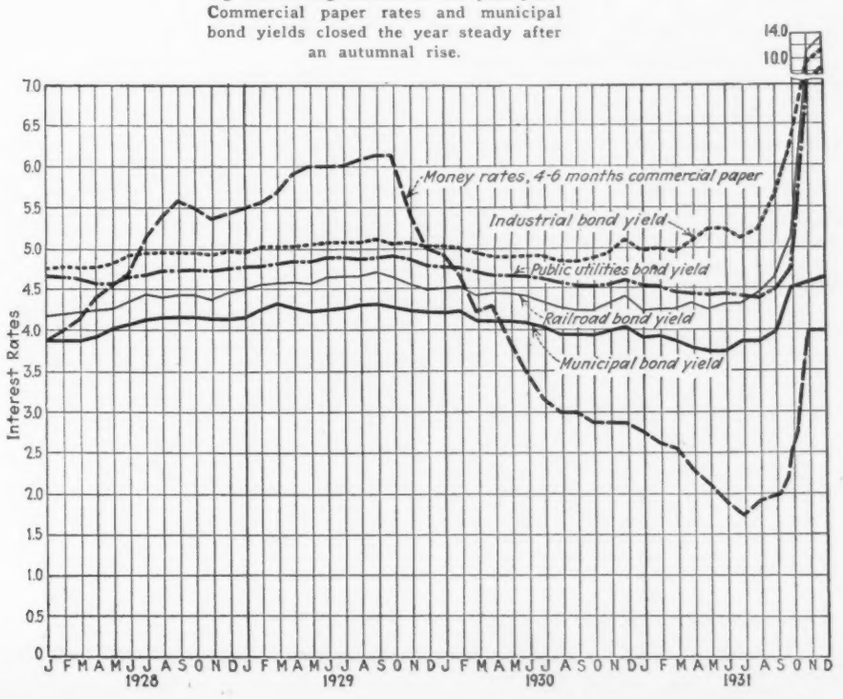


Fig. 8—Industrial, public utility and railroad bond yields went skyward during the closing months of the past year. Commercial paper rates and municipal bond yields closed the year steady after an autumnal rise.



Situation is general

This situation is not limited to a few localities but is a general municipal financing situation. Not only is new financing difficult at present; the difficulties extend also to renewing, even for short terms. The price level of municipal bonds is believed to be too high, and the deflating process is evidenced by an increase in yield in 1931 from 4 per cent to 5. Yield on New York City bonds, for example, increased from 4 to 5.5 per cent in a few months. Bankers, dealers, and investors

TABLE VI—CONSTRUCTION FINANCING

(Millions of Dollars)

	Corporation Financing	Public Bond Sales	Gasoline Taxes	Federal Government	Total
1919	$2,023	$1,220	.....	$788	$4,031
1920	2,348	1,439	.....	422	4,209
1921	1,664	2,149	.....	421	4,234
1922	2,006	1,615	.....	325	3,946
1923	2,503	1,650	.....	248	4,401
1924	2,835	2,426	.....	310	5,571
1925	3,178	2,272	.....	309	5,759
1926	3,247	2,024	.....	274	5,545
1927	3,765	2,105	$259	290	6,419
1928	3,729	2,107	306	304	6,446
1929	4,481	2,327	432	352	7,592
1930	4,031	2,163	495	285	6,974
1931	1,500	2,038	546*	446	4,530

*$246 first six months; Est. $300 last six months.

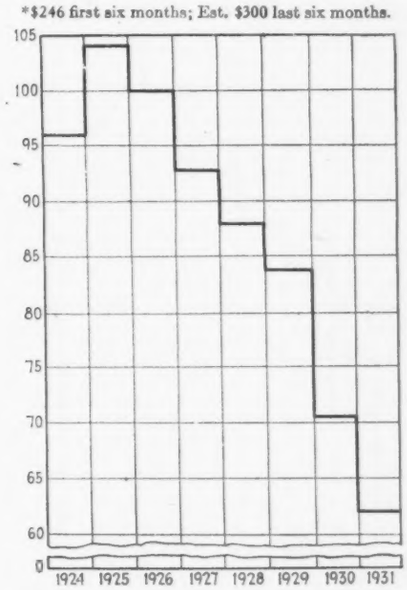


Fig. 9—Real estate transfers, closely affiliated with construction activities, have fallen off. Index of deeds recorded in 64 cities, 1926 = 100.

TABLE VII — PRODUCTION, SHIPMENTS AND STOCKS OF PRINCIPAL CONSTRUCTION MATERIALS

	Total 1931	Total 1930	Per Cent Change
Fabricated Structural Steel:			
Bookings, tons	1,904,400	2,689,600	—29.1
Shipments, tons	1,837,200	2,987,200	—38.6
Fabricated Steel Plate:			
New orders, tons	302,509	469,435	—35.6
Unfilled Tonnage (U.S. Steel):			
Orders, tons, Dec. 31	2,735,891	3,943,596	—30.8
Commercial Steel Castings:			
New orders, tons (11 mos.)	372,792	835,046	—55.5
Production, tons (11 mos.)	415,128	945,582	—56.1
Steel Ingots:			
Production, tons	24,900,195	39,286,287	—36.5
Range Boilers:			
Production, No. (11 mos.)	489,920	548,414	—10.8
Shipments, No. (11 mos.)	494,214	550,666	—10.2
Stocks, No. (11 mos.)	26,605	24,093	+10.8
New Orders, No. (11 mos.)	473,212	537,775	—11.9
Unfilled orders, No. (11 mos.)	7,520	20,091	—12.9
Steel Boilers:			
New orders, No. (11 mos.)	6,835,301	12,882,840	—47.0
Pig Iron:			
Production, tons	18,263,011	31,441,488	—42.5
Cast-Iron Pipe:			
Production, tons	800,000	1,186,000	—32.8
Radiators:			
New orders, M. sq.ft. h.s. (11 mos.)	72,500	81,068	—10.5
Production, M sq.ft. h.s. (11 mos.)	62,700	74,052	—15.3
Shipments, M sq.ft. h.s. (11 mos.)	72,800	78,674	— 7.4
Stocks, M. sq.ft. h.s. (11 mos.)	34,388	41,420	—17.2
Track Work:			
Production, tons (11 mos.)	58,100	104,942	—45.0
Maple Flooring:			
New orders, M bd.ft. (11 mos.)	36,800	35,700	+ 3.0
Production, M bd.ft. (11 mos.)	36,400	43,500	—16.3
Shipments, M bd.ft. (11 mos.)	33,000	40,700	—18.9
Stocks, M bd.ft. (11 mos.)	20,216	23,353	—13.3
Unfilled orders, M bd.ft. (11 mos.)	4,851	3,204	+51.5
Oak Flooring:			
New orders, M bd.ft. (11 mos.)	242,600	398,200	—39.2
Production, M bd.ft. (11 mos.)	234,300	324,500	—27.8
Shipments, M bd.ft. (11 mos.)	243,600	326,700	—25.4
Stocks, M bd.ft. (11 mos.)	68,293	85,000	—19.8
Unfilled orders, M bd.ft. (11 mos.)	14,344	68,000	—79.0
Lumber (softwood):			
Production, M bd.ft.	8,532,265	12,498,366	—31.4
Shipments, M bd.ft.	9,248,989	12,139,089	—24.0
New orders, M bd.ft.	8,951,661	11,828,614	—24.6
Unfilled orders, M bd.ft.	455,820	708,997	—35.8
Stocks, M bd.ft.	4,044,014	4,771,855	—15.3
Cement:			
Production, bbl. (11 mos.)	118,596,000	152,425,000	—22.4
Shipments, bbl. (11 mos.)	122,323,000	153,056,000	—20.2
Stocks, bbl. (11 mos.)	22,223,000	23,056,000	— 3.6
Enameled Sanitary Ware.			
New orders, pcs. (11 mos.)	1,685,269	2,207,153	—23.6
Shipments, pcs. (11 mos.)	1,783,629	2,286,474	—21.9
Paint (mixed):			
Sales, lb. (11 mos.)	921,874	953,778	— 3.3
Calcimine:			
Sales, lb (11 mos.)	33,935,389	36,282,792	— 6.3
Porcelain Plumbing Fixtures:			
Shipments, pcs. (11 mos.)	48,567	69,199	— 2.9
New orders, pcs. (11 mos.)	55,394	83,449	—33.6
Unfilled orders, pcs. (11 mos.)	6,072	29,869	—80.0
Stocks, pcs. (11 mos.)	19,597	30,370	—35.6
Prepared Roofing:			
Shipments, squares (11 mos.)	21,587,369	26,747,660	—19.5
Terra Cotta:			
New orders, tons (11 mos.)	40,548	70,866	—42.9
Vitreous China:			
Plumbing fixtures			
New orders, pcs. (11 mos.)	1,494,173	1,712,113	—12.9
Shipments, pcs. (11 mos.)	1,554,473	1,918,314	—18.9
Unfilled orders, pcs. (11 mos.)	199,009	235,567	—15.3
Stocks, pcs. (11 mos.)	501,972	582,675	—13.9
Explosives:			
Production, lb. (11 mos.)	51,940,000	65,600,000	—20.9
Shipments, lb. (11 mos.)	52,800,000	65,400,000	—19.3
Brick, Common			
Stocks, M (11 mos.)	524,760	429,896	—22.1
Brick, Face:			
(Avg. per plant)			
Production, M (11 mos.)	4,811	7,362	—34.7
Shipments, M (11 mos.)	5,165	8,136	—36.6
Stocks, M (11 mos.)	3,521	3,677	— 4.1
Unfilled orders, M (11 mos.)	457	821	—44.4
Brick, Sand-lime:			
Production, M (11 mos.)	56,000	94,625	—40.9
Shipments, M (11 mos.)	58,100	96,427	—39.8
Stocks, M (11 mos.)	10,035	12,730	—21.2
Unfilled orders, M (11 mos.)	10,485	8,183	—87.4
Paint:			
Sales, $1,000 (11 mos.)	178,000	199,000	—10.5

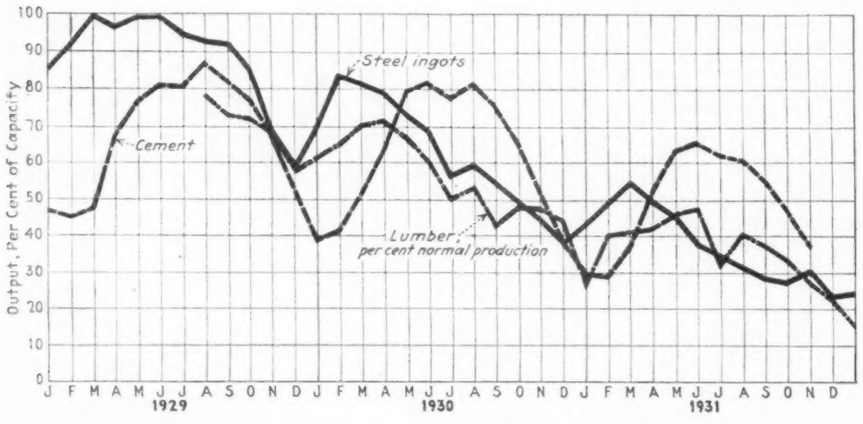

Output, Per Cent of Capacity
Steel ingots
Cement
Lumber, per cent normal production
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1929
1930
1931

Fig. 10—Output of the three major construction materials—steel, cement and lumber—was far below capacity production during 1931, although cement production showed its usual summer rise.

assert that municipalities must accept the deflation situation and economize toward raising their credit.

Yields of other bonds jumped at a much greater rate during the closing months of 1931. Railroad bond yields increased from an average of 4.75 to 13.8, industrials from 5.0 to 11.8 and public utilities from 4.5 to 9.0 During the same period money rates on commercial paper jumped from 1.7 to 4.0 per cent.

Gas tax growing

Gasoline taxes have been an increasingly important source of revenue for construction. Since 1927 the yearly amount of the tax has increased from $259,000,000 to $546,000,000. In the past practically all this revenue has been spent directly on highway construction. But at present there are several states proposing to divert these easily-collected funds to other uses.

In the past twelve-year period the total construction financing started at 4 billion dollars a year. It slowly raised to 7,592 millions in 1929 and dropped the succeeding two years.

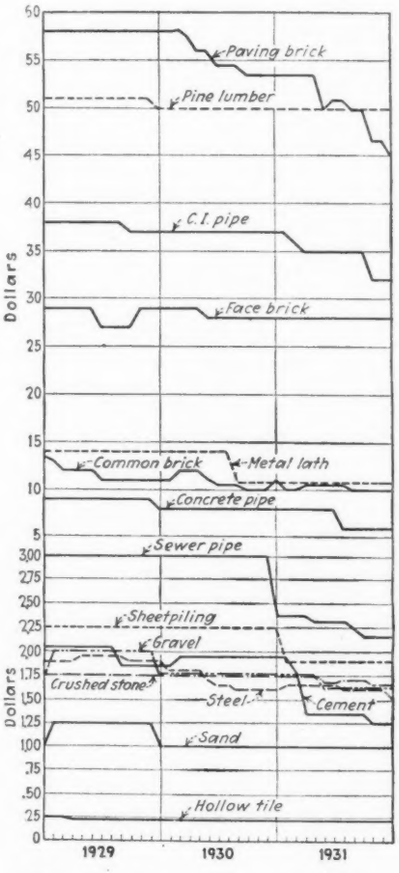


Fig. 11—Many of the construction materials showed the effects of price wars during the past year, while others maintained steady prices in the face of general falling markets. The prices shown are for carload lots, f.o.b. the following points: paving brick, 3½x8½x4 in., per M, New York; pine, 3x12 in.x20 ft., mer. rough per M. bd. ft., New York; C-I pipe, 6 in., per ton, Birmingham; face brick, average qual., per M, New York; metal lath, 2½ lb. per sq.yd., per 100 sq.yd., Chicago; sand, per cu.yd., New York; hol-concrete pipe, 30 in., made adjacent to job, per lin.ft., Newark; sewer pipe, 30-in. vit., per lin.ft., Pittsburgh; sheetpiling, base per 100 lb., Pittsburgh; crushed stone, 1½ in., per cu.yd., New York; gravel, 1½ in., per cu.yd., New York; structural shapes, base per 100 lb., Pittsburgh; cement, net per bbl., Chicago; sand, per cu.yd., New York; hollow tile, 10x12x12 in., per block, Perth Amboy, New Jersey

Production of Construction Materials Off From Previous Years; Some Prices Slump

WITH the decline of construction volume, material markets became sluggish during the year with a corresponding decline in prices of many commodities. Prices of other commodities stood up in the race of general falling markets and reduced outputs.

Cement production, from a high output of 88 per cent capacity in August, 1929, fell to an average of less than 50 per cent capacity production in 1931, though the usual early summer demand raised the high output of the year to two-thirds capacity in May. From a full-capacity production in 1929, the output of steel ingots fell to 25 per cent of capacity at the end of 1931, reaching a high for the year of 55 per cent in March. Lumber production

TABLE VIII—COMPARISON OF ACTUAL AND SCALE BUILDING TRADES WAGES FOR VARIOUS CITIES

	Carpenters		Bricklayers		Plasterers		Iron Workers		Skilled (Ave.)		Per cent Decrease	Common		Per cent Decrease
	Dec. 15	Scale	Dec. 15	Scale	Dec. 15	Scale	Dec. 15	Scale	Dec. 15	Scale		Dec. 15	Scale	
1 Birmingham, Ala.	$0.60	$1.00	$0.75 @0.87½	$1.50	$0.75	$1.25	$0.75 @0.80	$0.80	$0.76	$1.14	33.4	$0.15 @0.25	$0.30	33.4
2 Montgomery, Ala.	.70	.....	1.00	.....	1.00	.....	.80	.....	.88	.....	.....	.20	.....	.....
3 Los Angeles, Cal.	$0.50@0.75	1.00	.62½@ .87½	1.37½	.87½	1.50	.75	.87½	.73	1.19	38.6	.40	.50	20.0
4 San Diego, Cal.	.75@1.00	1.00	1.00 @1.12½	1.50	1.00 @1.12½	1.50	.87½@1.00	1.12½	.99	1.28	22.6	.43½	.62½	30.0
5 Pueblo, Colo.	.75	.....	.75	.....	1.25	.....	.....	.....	.92	.....	.....	.30 @ .40	.....	.....
6 Bridgeport, Conn.	.75@1.00	1.37½	1.25	1.62½	1.25	1.62½	1.60	1.65	1.71	1.57	25.5	.50 @ .75	.87½	.....
7 Wilmington, Del.	.70@ .80	1.00	.90 @1.37	1.25	1.50	1.50	.60	1.37½	.98	1.28	23.4	.30 @ .40	.50	30.0
8 Tampa, Fla.	.60	.80	1.00 @1.25	1.25	1.00	1.25	.85 @1.00	1.25	.95	1.41	16.7	.25 @ .30	.50	45.0
9 Atlanta, Ga.	.40@ .60	.70	.75 @1.12½	1.25	.65 @1.00	1.25	.60 @1.12½	1.25	.78	1.11	29.8	.20 @ .25	.35	35.8
10 Boise, Idaho	.50	1.00	.75	1.50	.62½	1.25	.50	1.00	.60	1.19	49.5	.25	.50	50.0
11 Bloomington, Ill.	.90	1.12½	1.62½	1.62½	1.50	1.50	.....	.....	1.34	1.42	5.6	.30	.65	54.0
12 Chicago, Ill.	1.00	1.62½	1.00	1.70	1.00	1.70	1.00	1.67½	1.00	1.68	40.5	.50 @ .75	.97½	35.8
13 Rockford, Ill.	.95	1.15	1.25	1.25	1.25	1.25	1.25	1.25	1.18	1.23	4.0	.50	.50	.....
14 Anderson, Ind.	.85	.....	1.00	.....	1.95	.....	.....	.....	1.27	.....	.....	.30 @ .35	.....	.....
15 Indianapolis	1.00	1.22½	1.30	1.62½	1.26	1.62½	1.16	1.45	1.18	1.49	20.8	.30	.35	14.3
16 Davenport, Ia.	1.00	.....	1.50	.....	1.50	.....	1.25	.....	1.31	.....	.....	.40	.....	.....
17 Des Moines, Ia.	1.00	1.12½	1.25	1.50	1.37½	1.50	1.12½	1.25	1.19	1.35	11.8	.67½	.67½	.....
18 Sioux City, Ia.	1.00	1.12½	1.25	1.50	1.12½	1.37½	.....	1.00	1.13	1.25	9.6	.35	.40	12.5
19 Louisville, Ky.	.60	1.00	.70	1.50	.75 @ .80	1.62½	.75	1.25	.72	1.35	46.5	.20	.30	16.7
20 Boston	1.00	1.37½	1.00	1.50	1.00	1.62½	1.00	1.37½	1.00	1.47	47.0	.40	.80	50.0
21 Portland, Me.	.80	1.00	1.40	1.50	1.37½	1.50	.85	1.25	1.11	1.31	15.3	.39 @ .50	.60	25.8
22 Cumberland, Md.	.35@ .50	1.00	1.50	1.50	1.25	1.25	.75	1.25	.87	1.25	30.4	.25	.50	50.0
23 Dearborn, Mich.	.35@ .60	.....	.40 @ .75	.....	.40 @ .65	.....	.....	.....	.53	.....	.....	.20	.....	.....
24 Detroit	.70@ .80	.80	1.25	1.50	1.00 @1.25	1.37½	1.00	1.10	1.00	1.20	16.6	.45	.50	10.0
25 Saginaw, Mich.	.80	.....	1.25	.....	1.00	.....	1.00	.....	1.01	.....	.....	.25 @ .35	.....	.....
26 Minneapolis	.75	1.00	1.10	1.37½	1.00	1.25	.....	1.25	.95	1.22	22.1	.45	.69	34.5
27 Butte, Mont.	1.25	1.25	1.50	1.62½	1.50	1.62½	1.25	1.25	1.38	1.44	4.2	.69	.72	4.3
28 Helena, Mont.	1.00	.....	1.25	.....	1.25	.....	1.00	.....	1.13	.....	.....	.50	.....	.....
29 Trenton, N. J.	1.25	1.50	1.65	1.65	1.65	1.65	1.75	1.75	1.58	1.64	3.6	.35 @ .45	.....	.....
30 Santa Fe, N. M.	1.12½	.....	1.50	.....	1.50	.....	.....	.....	1.38	.....	.....	.35	.....	.....
31 New York City	1.00	1.65	1.50	1.92½	1.50	1.92½	1.92½	1.92½	1.48	1.86	20.4	.50 @ .94	1.03	30.3
32 Oswego, N. Y.	1.00	.....	1.50	.....	1.50	.....	1.25	.....	1.31	.....	.....	.50	.....	.....
33 Syracuse, N. Y.	.60@1.00	1.32	.60 @1.00	1.65	.60	1.65	1.37½	1.50	.86	1.53	43.7	.30 @ .50	.87½	51.5
34 White Plains, N.Y.	1.25	.....	1.50	.....	1.50	.....	.....	.....	1.42	.....	.....	.50	.....	.....
35 Greensboro, N. C.	.40@ .60	.....	.75	.....	1.00	1.00	.50 @1.50	1.50	.79	1.25	36.8	.20 @ .40	.....	.....
36 Akron, O.	.75@ .80	.95	1.45	1.55	1.00 @1.62½	1.62½	.80 @ .85	1.15	1.04	1.32	21.2	.40	.50	20.0
37 Canton, O.	.60@1.00	1.25	1.50	.....	1.50	.....	1.00	.....	1.12	1.25	10.4	.40	.....	.....
38 Cincinnati, O.	.50	1.40	.90	1.62½	.90	1.62½	1.00	1.40	.83	1.52	45.5	.25 @ .45	.60	41.5
39 Cleveland, O.	.87½	1.12½	1.25	1.62½	1.12½	1.68½	1.00 @1.25	1.50	1.10	1.49	26.2	.40 @ .50	.87½	48.5
40 Columbus, O.	.75@ .80	1.00	1.25 @1.35	1.56	1.00 @1.25	1.62½	1.25 @1.40	1.50	1.13	1.42	20.4	.30	.50	40.0
41 Dayton, O.	.60@ .75	1.00	1.00 @1.30	1.62½	1.25	1.56	.....	1.35	.98	1.39	29.4	.30 @ .40	.55	36.4
42 Hamilton, O.	1.26½	.....	1.62½	.....	1.50	.....	.....	.....	1.47	.....	.....	.40	.....	.....
43 Oklahoma City	.62½	1.12½	.62½	1.62½	.50	1.62½	.75	1.25	.63	1.41	55.2	.25	.50	50.0
44 Tulsa, Okla.	.50@ .75	1.00	.75 @1.00	1.70	.75 @1.00	1.70	.65 @ .75	1.25	.77	1.41	45.5	.20 @ .35	.....	.....
45 Portland, Ore.	.85	1.12½	1.12½	1.50	1.12½	1.50	1.03	1.37½	1.04	1.38	24.6	.50	.75	33.3
46 Bethlehem, Pa.	.50	1.00	.90	1.50	.90	1.50	.85	1.50	.79	1.38	42.7	.30	.40	25.0
47 Philadelphia	.80@1.00	1.25	1.50	1.75	1.62½	1.62½	1.37½	1.62½	1.26	1.57	19.7	.30 @ .45	.60	37.4
48 Pittsburgh	.60@1.50	1.50	.60 @1.75	1.75	.60 @1.66	1.66	.60 @1.50	1.50	1.10	1.60	31.2	.40	.80	50.0
49 Scranton, Pa.	.75	1.12½	1.00	1.50	1.00	1.25	1.00	1.25	.94	1.28	26.6	.35	.40	12.5
50 Wilkes-Barre														
51 Greenville, S. C.	.25@ .50	.....	.50 @ .80	.....	.50 @ .80	.....	.....	.....	.56	.....	.....	.12½@ .15	.....	.....
52 Chattanooga	.50	.75	1.00	1.50	1.00	1.50	.....	1.00	.83	1.19	30.2	.20	.25	20.0
53 Knoxville	.40	.....	1.00	.....	.75	.....	.....	.....	.72	.....	.....	.20 @ .25	.....	.....
54 Memphis	.50@1.00	1.00	1.37½	1.62½	1.56	1.25	1.00	1.25	1.09	1.28	14.8	.20 @ .25	.50	55.0
55 Amarillo, Tex.	1.00	.....	1.25	.....	1.25	.....	1.25	.....	1.19	.....	.....	.35	.....	.....
56 Dallas	.75	.87½	1.00	1.12½	1.00	1.12½	1.00 @1.12½	1.25	.72	1.10	34.5	.20 @ .30	.40	62.5
57 Ft. Worth														
58 San Antonio	.87½	1.12½	1.00	1.50	1.25	1.50	.87½	1.12½	1.00	1.32	27.2	.25	.34½	27.4
59 Salt Lake City	1.00	1.12½	1.25	1.37½	1.20	1.25	1.12½	1.12½	1.15	1.22	5.7	.44	.50	12.5
60 Norfolk, Va.	.50@ .60	.80	1.25	1.50	1.00	1.35	.70	1.25	.81	1.23	34.2	.25	.35	28.6
61 Richmond, Va.	.80	.90	1.50	1.50	1.25	1.50	.87½@1.12½	1.50	1.11	1.35	17.8	.40	.40	.....
62 Roanoke, Va.	.50	.....	.80	.....	.80	.....	.90	.....	.75	.....	.....	.25	.....	.....
63 Seattle, Wash.	.50	1.12½	.75	1.50	.75	1.50	1.25	1.25	.81	1.35	40.0	.50	.70	28.6
64 Tacoma, Wash.	.66	1.00	1.00	1.50	1.00	1.50	.84	1.25	.88	1.31	32.8	.40	.62½	36.0
65 Charleston, W.Va.	.50	1.12½	..50	1.50	1.50	1.50	.75	1.00	1.06	1.28	17.2	.25	.40	37.4
66 Wheeling, W. Va.	.50@ .60	1.25	.50 @1.00	1.50	.60 @1.00	1.75	.40 @ .80	1.50	.68	1.50	54.5	.30 @ .35	.....	.....
AVERAGE	$0.76	$1.10	$1.11	$1.52	$1.11	$1.47	$1.02	$1.31	$1.00	$1.35	25.9	$0.37	$0.55	32.7

stumbled along at 40 per cent normal production for most of last year, but fell to 16 per cent of normal in December. Production, shipment and stocks of principal construction materials for the year are given in Table VII.

The effect of price wars during the year is shown in price trends of many construction materials. Cement prices tumbled in February and March, with another slight drop in September. Paving brick held firm for the first four months, dropped considerable, rallied and then crashed steadily for the past six months. Cast iron pipe felt two declines, sheetpiling and concrete pipe one each. Face and common brick, metal lath, sand, gravel, crushed stone, steel and hollow tile held steady.

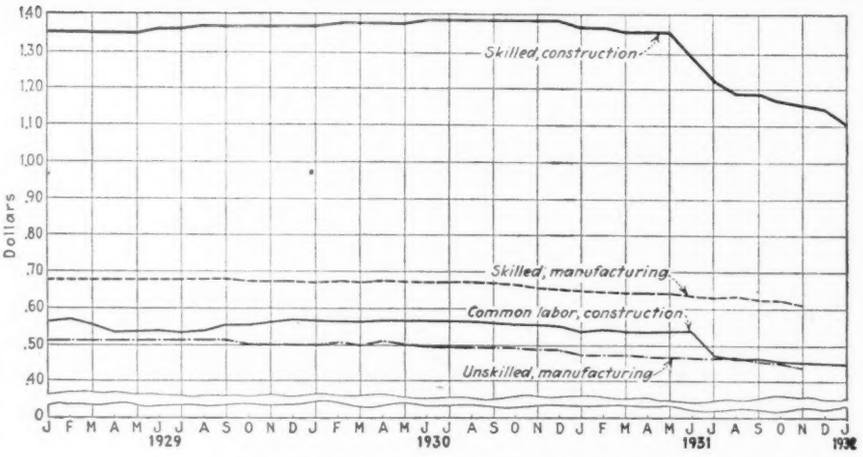


Fig. 12—Skilled construction wages reacted to unemployment conditions during the past year. Common construction wages also took a mid-summer drop. Industrial wages maintained a three-year average.

Skilled and Common Construction Wages Reacted to the Unemployment Situation Last Year

THE unemployment conditions throughout the country have extensively affected construction wages during the past year. The effect has been most serious in the building trades, where, at the close of 1931, 62 per cent of the skilled labor was out of work, compared to 23 per cent average for all industries.

While manufacturing wages, both skilled and unskilled, remained fairly steady, wages of skilled labor in construction started falling in December a year ago from an average of $1.38 per hour to an average of $1.10 at the close of the past year. The average common construction wage rate took a cent or two drop a year ago, then averaging 55c., remained steady until June, dropping to about 46c. and declining another 2c. by the end of the year.

However, the real story in construction wages is given in Table VIII showing the breakdown in building trades wages below scale levels in 66 cities. The lowering of wages below scales has been going on throughout the year, but became more pronounced during the last two months of the year. On Dec. 15 the average skilled wage actually being paid in the 66 cities was 25.9 per cent below average scale level. Common wages actually paid were 32.7 per cent below scale. Attempts are now being made in several places to revise the scales downward in keeping with general conditions.

There has been considerable activity in prevailing wage legislation in an effort to boost or at least maintain wages. Much of this legislation has failed to pass. In two instances, in Illinois and Arizona, prevailing wage acts were declared unconstitutional. The Bacon-Davis act, affecting federal building only, became effective in March. It is felt in construction circles that the law is indefinite and ineffective, and steps are being taken towards its revision.

As a measure of providing relief to unemployment, many contractors are now successfully using some sort of stagger system of employment. Some are alternating crews every week, some every half-week, while others are working their men four or five days out of six, rotating the crews in such order that few newcomers are on each shift.

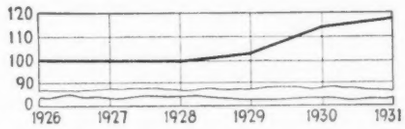


Fig. 13—The productivity and efficiency of construction labor today is 118 per cent of that of 1926.

Budgets and Estimates for Construction Indicate Decrease For 1932 From the 1931 Volume

VERY few departments have definite budgets for 1932 as yet. But from various sources of information and from those budgets that have been published, indications point to a decrease in 1932 from the 1931 construction total.

The federal government expenditures for construction will probably show the only increase over 1931 figures. This work is estimated at $458,000,000, an increase of $12,000,000 over the past year. Residential construction is expected to fall $100,000,000 from the 1931 total of $885,000,000. Non-residential building is estimated at $870,000,000, compared to last year's total of 1,220 millions.

Highway construction will probably be from 10 to 15 per cent off from the 1931 volume, according to the present outlook. Several highway departments have already announced intentions of retrenching. Public utilities construction budgets are estimated at 1½ billions, but this figure includes funds for equipment, not strictly construction.

Construction in the municipal field for 1932, encouraged by the necessity for providing unemployment relief, will probably equal that of last year, though in some cases municipal work will be retarded by tax reduction programs and crippled city finances. Construction budgets for 1932 for eleven cities, shown in Table IX, total to a figure considerably above the amount spent by them in 1931. It is expected that municipal and public work other than highways and federal in 1932 will approach the 1931 total of 1,900 millions.

In all, it looks as if 1932 construction will be between 5 and 5.5 billion dollars, which approaches the 5.8 billion volume of 1923.

TABLE IX — ESTIMATED PUBLIC CONSTRUCTION BUDGETS OF ELEVEN CITIES

(Thousands of Dollars)

	Water-Works	Bridges	Sewers	Buildings	Streets	Other	Totals Est. 1932	Totals 1931	Totals 1930
Cleveland	2,000	200	4,500	2,500	2,500	.....	11,700	12,563	20,755
Columbus	125	.....	5,500	50	150	75	5,900	2,324	2,597
Dallas-Ft. Worth	1,500	200	2,500	.....	5,000	.....	9,200	16,500	32,500
Los Angeles	11,950	3,190	1,300	.....	3,473	8,169	28,082	15,366	14,268
Okla. City	125	.....	67	.....	110	.....	302	746	977
Omaha	500	1,600	750	2,750	100	30	5,730	4,213	4,215
St. Louis	1,000	1,200	1,000	6,000	1,250	500	10,950	7,439	11,848
Seattle	706	1,440	548	.....	1,377	1,327	5,398	6,960	7,907
Sioux City	60	15	10	15	75	.....	175	407	333
Wilmington	72	457	100	2,921	2,727	403	6,680	1,993	1,909
Roanoke	.....	8	126	5	215	15	369	539	178
Total	18,038	8,310	16,401	14,241	16,977	10,519	84,486	69,050	97,487

Business Breakdown and Recovery as Related to Construction

A brief account of how our economic structure was built up and overloaded—The construction industry's part in recovery

By Virgil Jordan, Economist, McGraw-Hill Publishing Co., New York, N. Y.

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IT IS WIDELY BELIEVED that the construction industry will lead the way back from depression, and therefore the relation of the industry to general business activity and stability is important. To throw light on this relation, a leader of economic thought here undertakes to describe our economic structure, its growth during the last fifteen years and the momentous changes that led to its overloading and breakdown.

Basing his conclusions on consideration of these factors, he points out how recovery and reconstruction are likely to proceed. "The construction industry occupies the key position," he concludes. But true stability is dependent on: (1) finding new channels of capital investment; (2) improving the fiscal policy of governments; and (3) integrating and reorganizing the construction industry. —EDITOR

◆

LOOKING BACKWARD from the beginning of 1932, one cannot help being astonished at the sweep and violence of the movements in American business during the past two decades. The many minor fluctuations are insignificant beside the two prolonged periods of expansion—one during the war, the other from 1922 to 1929—and the two periods of profound depression that followed them. The last of these, in which the world is now wallowing, has exceeded in severity and scope, though not yet in duration, anything in the record of American economic experience. The statistical measurement of these movements is still uncertain and approximate, but the accompanying charts will give some indication of their amplitude, and the tables an idea of the severity of the recession since 1929.

Powerful forces involved

IT MUST be obvious to the engineer, if not to the economist and statesman, that such oscillations imply the operation of vast uncontrolled forces in our economic life. Considering their consequences, it is clear either that they are not fully understood, or (so far as they are) that no effective means of controlling them has been found or applied. My purpose here is to sketch some of the things that are known about them, confining myself principally to the last of these two periods of expansion and depression. The records are more complete; the experience of it more immediate; and interest in it more intense.

The engineering mind must be struck by the similarity between the recent recession (as it appears, for example, in a curve of business activity, Fig. 1) and the collapse of some structure upon which too great a weight has been put or from which some of the supports have suddenly been removed. The course of the process of collapse as recorded in the charts reveals the same sort of periodic oscillations as are set up by the impact of powerful physical forces, like the seismographic record of an earthquake.

In times like the present the economist usually resigns himself to mere detailed description and is content to compile a catalogue of all the factors that have operated to produce the depression. One such list by a patient compiler contains 187 items to which the depression has been ascribed, ranging from sunspots to the defects of the Republican administration! But the fact that a large number of influences may have played a part does not preclude search for those that are important or decisive. The problem, in short, is to discover the excessive weight that caused the structure to collapse, and to distinguish the essential supports of the structure that weakened under it.

As I see it, the central elements in the economic structure that has been erected in this country during the past twenty years, and the sequence that resulted in its collapse, run somewhat as follows:

First, the war was the cornerstone of the whole structure. It resulted, in the first place, in an enormous expansion of credit in every country involved. This credit, created by governments with the aid of the banking system, was used to support a large part of the civilian population in the unproductive occupation of combat, to finance production of war materials and machines destroyed in battle or useless for any other purpose, and greatly to increase the capacity of industries producing these things.

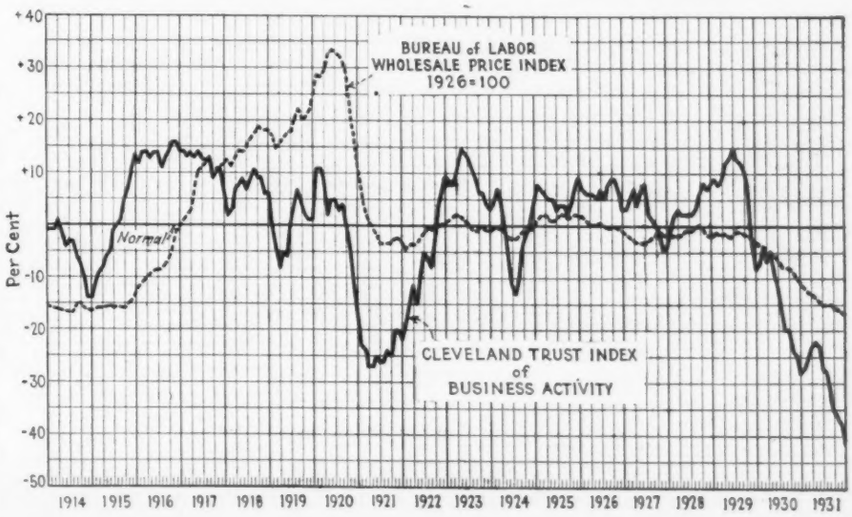
But, contrary to the popular conception, production of basic commodities for the world as a whole during the war did not expand at the average or normal rate of earlier years; it even contracted, because man power was so largely diverted to war service. It expanded so much less rapidly than credit, currency or purchasing power that prices quickly rose to unprecedented peaks, with proportionate decline in the value of the dollar and other currencies in which debts were contracted.

Overload by debt

ALL CREDIT is debt. The credit created during the war, principally public credit, piled up an enormous structure of public debt, internal and external, in every combatant country. This debt burden was the initial and largest contribution to the weight that has broken the world's back. While it was being contracted it represented less and less real wealth as prices rose, but its liquidation and repayment when prices declined was bound to create an impossible burden for the debtors.

Yet such a decline in prices was inevitable. When the limits of credit expansion and even of currency inflation were reached, when the artificial war-time demand for commodities ceased, when the expanded capacity of war industries was confronted with a

Fig. 1—Records of business activity and price levels indicate a breakdown in 1929 from overload or shock of the economic structure



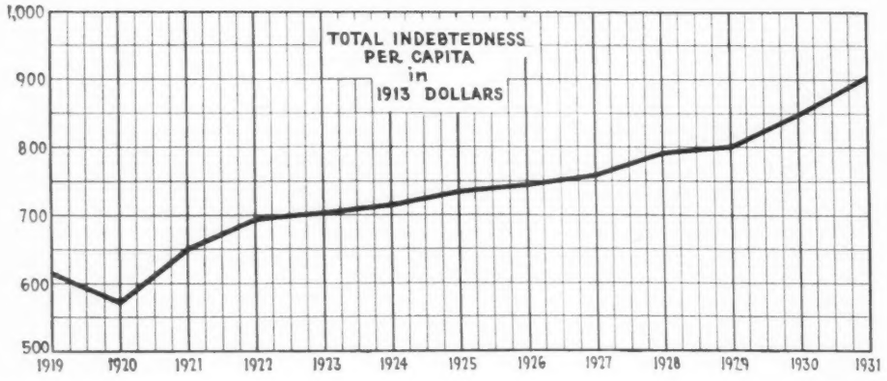


Fig. 2—Debts have been growing steadily during the last twelve years, and today the per capita real debt burden in the United States is 50 per cent greater than in 1919.

disappearing market, prices perforce collapsed, the burden of debts increased, and a vastly larger production of real wealth was necessary to meet them unless they were to be written down. This was partly postponed in this country by the short and swift secondary post-war boom in 1919 and 1920, financed by further credit expansion to facilitate exports to the war-wrecked countries; but in 1921 the first phase of the process of readjustment set in. The credit supports for commodity prices were contracted; some countries were forced to repudiate their internal debt burdens by devaluation or inflation of currencies; and there began the long process of scaling down intergovernmental debts, which is not yet ended.

Abnormal credit expansion

SECOND, the emergence of the United States from the war as a creditor nation, with an undamaged industrial structure ready for rapid development, was a second basic factor in the sequence of events. The war started an almost steady stream of gold flowing to this country as part payment for the goods we sent to Europe during the war. This supplied the basis for a second period of credit expansion, running from 1922 to 1929, almost as marked as that during the war but essentially different in character and effect.

In the first period the credit created had gone into the consumption of commodities principally for war purposes and to meet immediate post-war needs of crippled countries, and it led to inflation of commodity prices. In the second period of expansion the credit created went into expansion of productive capacity and into construction—all forms of fixed capital—here and abroad, and resulted in an inflation of capital values reflected in security prices. In this country it supported the immense demand, deferred by the war, for new construction, for improved and enlarged industrial equipment and for automobiles. Abroad it supplied the machinery with which the industries of Germany and newly created countries were established, rebuilt, or expanded, and a large part of it went into public construction supplying social services. In this way enormous amounts of bank credit, savings, corporate surpluses and profits were converted into fixed capital for productive purposes. In the process of conversion, of course, they were distributed here and abroad as current purchasing power to consumers in wages, and business activity was stimulated and sustained for a number of years. But there were several consequences or accompaniments of the process significant for the future.

A change in 1925

IN THE first place, a vast new accumulation of private debt, domestic and foreign, was piled on top of the public debt left by the war. Following the collapse of commodity prices in 1921, which increased the real burden of this public debt, commodity prices rose up to 1925, because the secondary credit inflation, particularly that extended abroad through foreign loans, increased purchasing power and demand faster than it increased productive capacity. But after 1925 productive capacity had been or was being increased by credit expansion faster than new purchasing power was being released to consumers through new construction. The pressure of domestic and international competition began to be felt, and commodity prices began slowly to decline. Whereupon, the weight of the public and private debt burden began to increase again.

Fig. 3—Inflation was aided by a huge increase in the gold stock of the United States resulting from the war.

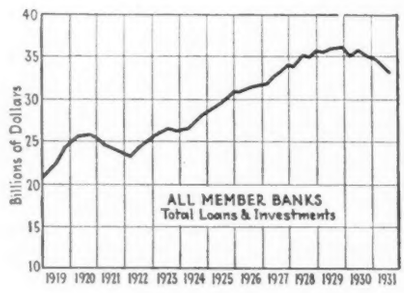


Fig. 4—Bank-credit expansion continued uninterrupted throughout the past decade, as shown by the total loans and investments of Federal Reserve member banks.

Although gold continued to come to this country with increasing speed as we expanded our exports and as foreign investors sought to share in the profits of rising security markets here, the rate of credit expansion on the basis of this gold began to fall off after 1925. More important was the fact that a diminishing proportion of the new credit created and of old savings and profits was being converted into current purchasing power by actual investment in new fixed capital. More and more of it was drawn into the speculative machinery to support the pyramids of investment trust and purely financial security flotations that were being piled up. Business corporations began to convert themselves into banking, investment and brokerage concerns, using their profits and surplus in increasing extent to support security speculation by lending in the call-money market, by buying and selling securities of other corporations, by floating issues of their own securities to get funds for these purposes. All this process supplied the basis for the bull market and the unprecedented security-price inflation of 1928 and 1929.

Banking and management at fault

THIRD, the banking and investment machinery created in this country during our first decade as a creditor nation, for the purpose of financing the expansion of productive capacity through which alone the war debt could be paid, finally destroyed the power of the market to absorb the goods produced. Mistaken wage and dividend policies of business management, and trade and tariff policies of governments played a part in this process, but the influence of the banking machinery was the underlying factor that upset the economic equilibrium. By discouraging the payment of higher wages to labor and larger dividends to stockholders, by encouraging the accumulation of excessive individual savings and corporate surpluses, by drawing these off into a pool of funds to be played with in the security market, the purchasing power of the consumers who absorb the bulk of the goods produced was prevented from keeping pace with the increase of productive capacity. When new investment in private or public fixed cap-

ital slowed down, the stream of purchasing power necessary to absorb the product of past investment and support profits on it dried up.

This process was partly offset by the increase of installment selling or extension of credit to consumers, by the increasing dissipation or wastage of capital through business losses in the period of "profitless prosperity" from 1925 on, and, in the last stages, by the widespread and free spending of speculative profits by small security-market speculators. But it was not sufficient to support the towering debt and credit structure that had been built up. This structure was made the more shaky by the increasing obstacles to international trade, which cut off the market for the increased and improved industrial capacity of other countries created with credit we had supplied. These obobstacles finally forced default, repudiation or writing down of international debts.

A three-legged stool

THUS, to summarize, we may consider the economic structure that has been erected in the past twenty years as a kind of three-legged stool. On top of it rests the vast burden of public debt due to the war, and of private debt created by post-war credit expansion in this country. The burden of that debt has increased and diminished with the fall or rise of the price level in all this period, but it is now fully 50 per cent greater than it was when the bulk of it was contracted. The three legs that support this debt structure that is the core of capitalism are: (1) the productive capacity of industry, which has been vastly expanded, especially since 1922; (2) the consuming power of the market, vastly and artificially increased during the war, supported by credit expansion thereafter but falling steadily shorter at least since 1925; and (3) the credit machinery, which should serve the purpose of keeping the stool steady by keeping the total volume of currency and credit purchasing power in step with productive capacity, but which has been subject to erratic and extreme expansions and contractions that have finally almost completely upset the structure.

Looking ahead

WHAT of the outlook as we turn from this picture of instability in the past and consider the present situation?

The economic system differs from an engineering structure essentially in the fact that it has the elasticity of life itself. Since 1929 readjustments and accommodations to the stresses and strains have been in process spasmodically, automatically and only in part according to deliberate plan. Things are happening to all the legs of the stool and to the weight on top. Equilibrium is being restored partly by the process of evaporation of debt burdens through

TABLE I—HOW THE RECESSION AFFECTED VOLUME

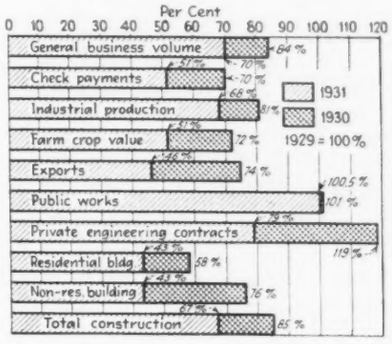


TABLE II—NATIONAL INCOME IN MILLIONS OF DOLLARS

1919	61,628	1926	80,284
1920	68,442	1927	82,921
1921	58,271	1928	84,119
1922	61,187	1929	89,424
1923	69,295	1930*	70,113
1924	71,905	1931*	60,513
1925	76,561		

* Estimates by Virgil Jordan and Robert Doane.

TABLE III—AVERAGE WEEKLY EARNINGS IN ALL MANUFACTURING INDUSTRIES (DOLLARS PER WORKER)

(Source: National Industrial Conference Board)

	1929	1930	1931
January	28.42	27.10	23.07
February	28.79	27.61	24.29
March	28.83	27.31	23.91
April	28.82	27.25	23.82
May	28.90	26.71	24.25
June	28.69	26.26	23.07
July	28.37	25.49	22.34
August	28.31	25.27	22.49
September	28.89	25.10	21.75
October	29.17	24.80	21.21
November	27.48	23.92	20.29
December	27.73	24.03	20.74

default, moratoria, repudiations and gradual scaling down through agreement, beginning in the international field. Capital values have been written down domestically all along the line perforce by private creditors in the market place, and governments are lowering internal debt burdens through devaluation of currencies. Secondly, industrial production has been drastically curtailed, and no doubt considerable industrial capacity has been destroyed through obsolescence or abandonment. Consumer purchasing power has been reduced, but it is questionable if it has been cut as drastically as capital values in the final stages, for it has been supplemented by relief funds derived from capital savings and increased by lower commodity prices, so that this leg of the stool has been lengthened relative to the others. Finally, at last the credit leg of the stool has been bolstered up and expanded by governmental action to strengthen the banking system and stimulate a new period of credit expansion through the Reconstruction Finance Corp., other financial agencies proposed by the President and new policies of the Federal Reserve.

Most of the adjustments made in the three legs of the stool have been the outcome of the action of millions of individuals in their private capacities as employers, consumers, investors, etc. But these have been slow and inadequate, and the government has been compelled to take a hand in the process on an increasing scale. Step by step it has been forced to intervene in the process, especially on the side of the credit structure so vital to the stability of the whole economic system.

Consider what the United States government did, in the way of intervention. First it sought by moral suasion to sustain consumer purchasing power by pledging business to sustain wages and maintain employment by carrying on or accelerating capital investment and construction programs during 1930. Then, through the Federal Farm Board it sought to maintain farmer purchasing power by pegging prices of farm products, and later to curtail production by private cooperative action or legislative and financial compulsion in the cotton and wheat states. Third, moratoria were declared on intergovernmental war debts and reparations. Fourth, came an effort to strengthen the banking system by stimulating private cooperation among bankers through the National Credit Corp. Finally, after this failed, the federal government was forced to step into the situation still more directly and prevent complete collapse of the credit structure by setting up a governmental banking institution to act as receiver for frozen assets of banks and to supply the indispensable credit needs of railroads and industry that could not be met through ordinary banking agencies. The fundamental effect of credit expansion made possible through this means, as well as through accompanying liberal credit policies of the Federal Reserve system, should be to raise the price level, reduce the value of the dollar and so lighten debt burdens.

Adjustment and recovery

ALL THESE adjustments together may be expected to steady the structure and start recovery. But its instability in the past does not encourage the conviction that it will not develop new stresses and strains that will disturb its equilibrium, even though such powerful external influences as the war do not again intrude. The problem of so adjusting the credit leg of the stool as to keep consumer purchasing power in step with productive capacity is still to be solved.

Construction industry the key

IN THIS the construction industry occupies the key position. Credit expansion and contraction in the past has exerted its influence on economic equilibrium mainly through construction, for the consumer purchasing power that supports other industries is distributed largely through new construction. The difficulty has been that construction in the past has been principally of a kind that has increased the capacity to produce goods for competitive sale and so has defeated the end it has served in the economic balance.

Yet no other way of keeping consumer purchasing power in step with output can be conceived in a capitalistic society than through continuous investment of savings and credit in construction of fixed capital. The crucial question that confronts the capitalist organization is whether and how such investment can be controlled so as to maintain the stability of the structure.

New channels of capital investment that will not increase productive capacity in the competitive market must be sought if the value of existing investments is to be maintained by steady increase of consumer purchasing power. The public construction of social facilities seems to offer the most promising solution of the problem. But it leads us to another still more difficult, that of taxation and public finance, which we have scarcely begun to consider with even as much intelligence as we have applied to the problems of our private financial and credit system, which is very little.

Economic stability, so far as the secret lies in control of construction, must be sought and will finally be found principally along the line of improvement in the fiscal policy of federal, state and local governments. Increased public construction to supply social services not competitive with private production is the inevitable and necessary means of maintaining consumer purchasing power in correlation with productive capacity. But the use of this powerful agency of stabilization is impossible without radical changes in public finance, especially the shifting of sources of tax revenues from real estate to income and the increased efficiency of public administration.

This approach may well be supplemented by closer integration and improved organization of the construction industries themselves. Such organization will make possible not only increased efficiency in construction, more stable employment and higher living standards for construction workers, but, what is more important, the exercise of more effective cooperative control of private investment in construction, which is essential to any stabilization that is to be permanent.

Construction—the Industry Nobody Knows

Experiences of 1930-31 have brought into clearer light the lack of industry organization that is the chief obstacle to stabilization

By R. C. Marshall, Jr., Vice-President, B-W Construction Co., New York, N. Y.

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TO SAY that construction is disorganized is only to assert the obvious. The alarming fact is that it has fallen into a lower state of morale in its depression than has business generally, and with less reason. Construction during the current depression has been doing 70 per cent of its normal business, while general business has been doing only 60 per cent. Yet construction has indulged in price competition, has abstained from normal buying, and in respect to prices and wages has cast sound practice to the winds.

In considering the causes for this condition in the following article, General R. C. Marshall, Jr., draws on experience as a government engineer, as director of war construction, as general manager of the Associated General Contractors, and in recent years as a contractor actively engaged in bidding and carrying out construction operations. A student of construction from many angles, General Marshall commands the reader's close attention. —EDITOR.

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QUO VADIS? This is not a biblical quotation but is two Latin words meaning, "Whither goest thou?" The query is appropriate to the construction industry. It is just as appropriate to ask: Where are we now? And the answer to either question is not evident.

Since the opening of the World War in 1914, construction has been through most of the cycles that are possible. Also, many of us have been trying to analyze these cycles, without much success. The several interests of construction are far flung, and each has considered that it must endeavor to take care of itself. The result is that when one sits down to soliloquize on the problem or to endeavor by introspection to find the reason for non-cohesion and deplorable business conditions, he necessarily begins to particularize; he has no composite picture to look at. Hence, in mentally viewing one phase he is unable to measure its effect on a great many components.

Construction totaled nine billions in 1929, dropping to 7.8 billions in 1930, and to about six billions in 1931. There is no promise of an increase in 1932. From 1922 to 1929, inclusive, the industry gradually approached the summit of overproduction; then suddenly it fell into the abyss of underproduction.

Can anyone doubt that we are in need of knowledge? It is certain that we are in a low volume of construction work, particularly of private construction. But is this sufficient reason for the price disorganization that reigns in industry? During 1931 a quotation made at any time could be resolved into a purchase at 10 per cent less three months thereafter.

A voiceless industry

CONSTRUCTION is 10 per cent of the trade of the country; also, it induces trade and therefore becomes responsible for perhaps 20 or 30 per cent of the trade of the country. It is the second largest of our industries. It is the nation's savings bank, in which the ultimate savings of the country find their final lodgment. Yet it is the least organized, most segregated, most vacillating of all our industries, criticised and held up to contumely, unable to defend itself, without a voice to make itself articulate.

What has been done to nationalize the construction industry? Such an idea was projected out of the world war. Prior to that time no serious thought or effort was given to this subject except by such a limited number as to make the movement no more than a flurry. During and since the war efforts to take account of itself have been made by a sufficient proportion of the industry to have assumed almost national proportions in the beginning. Unfortunately, all of them have died at birth. Similarly, several of the integral groups of industry have made national efforts to act each for itself. These have had various degrees of growth—some reaching infancy, some childhood, some adolescence, but none young manhood.

Price competition basic evil

SO, AFTER ALL, the inept conclusion arrived at is that construction is where it is. Why?

A controlling reason is that price competition is the accepted principle of construction. The corollary of price competition is quality competition—not competition for good quality, but competition for poor quality. It is to the great credit of the industry that this logical corollary is honored mostly in the breach, for it seems to be an accepted fact that the construction work of America is the best in the world. But like a leech this ethics-destroying attribute of price competition has fastened itself so firmly onto our construction life that, astounding as it may seem, politicians, bankers, labor, and indeed some manufacturers, contractors, engineers and architects believe it to be correct.

Yet, let us see some of the things

it is responsible for. It is responsible for architect and engineer auctioneering to general contractors, who peddle to subcontractors, who pass the bid-shopping along to manufacturers. All along the line that burden of price competition is passed, to the utmost limit—labor. The resultants are the evils that all of us know. Each in his own thinking attributes his troubles to the particular thing that is deviling him at the time, but the particular evil is really an outgrowth of the general evil.

Labor lacks permanence

A DISINTERESTED view of the vicissitudes of labor in construction leads one to wonder why any laboring man should choose one of the construction crafts as his vocation. The construction mechanic has no permanent employer and no permanent place of employment. Consequently, we can hardly expect that degree of loyalty (there are exceptions) to the employer that might be expected where employment is permanent. The allegiance of the employee is to the industry rather than to the employer. This has been one of the two-edged swords cutting construction into fragments.

The tendency of the employer is to discharge a man who has perhaps offended at the moment. The effect of this on labor during the formative period of self-protection was bombs and explosions.

We condemn some of the methods labor has used. It is entirely probable that the better element of labor also condemned them but saw those methods as the only ones with which to attain self-protection. The meaner element in labor took every advantage afforded by the condition; but when all is said, after some 50 years of effort, labor has reached a place in the councils of industry and does conduct itself in a manner more decorous from the business man's point of view than formerly.

Just how far the bad conditions in the construction industry grew out of this labor situation is indeterminate. No man thinking of the evolution of the construction industry can escape the idea that the relationship of labor in construction has had a profound influence on its conduct and reputation.

The low bid dominates

ABOUT one-third of construction is public works, and a fair proportion of the remainder partakes of the nature of public works, being for public utilities. It would seem that if the construction industry were articulate, it could address itself to this group, which is perhaps the most definite group addressable, and make an effort at least to modify the system to which so many of its ills are attributable.

In public works, as a matter of practice, the sole qualification is ability to make a bond—yes, there are some exceptions, but you can put them in your eye! Why is there not some method that can at least abate the effect of this terrible price competition in public works, which so largely influences the commercial field—some method of prequalification or of limitation, so that award of public works may be made in a way that will tend to stabilize, particularly in times of depression, rather than to demoralize, as does the present practice?

Classifying contractors

SEVERAL modifications of the present methods are suggested from time to time. All of them are admittedly full of holes. Each has a tendency to stabilize the industry and to decrease the demoralization. Two among them might be mentioned.

One proposal is that some bidder other than the low bidder be selected, say the third from low. Another is to list all subcontractors and general contractors who do public works in their several categories based upon their experience, financial standing and such other safeguards as are reasonable or which have a tendency to stabilize. Each man, firm or company would be listed within a range of size of work and perhaps of character of work in which he is permitted to operate. He would be listed in only one category and would not be permitted to take work in any other category. Under this latter plan, for example, a general contractor who presents the qualification and is rated to do work between $500,000 and $1,000,000 would not be permitted to solicit work below $500,000 or above $1,000,000. He should be able, of course, to reclassify up or down in volume under the rules laid down, but he should be permitted to operate only in the category where he is classed for the time being.

This system, despite many objections, would tend to decrease wildcatting. Each political subdivision having charge of public works would require listing before one was eligible in their bailiwick. Would this not tend to prevent municipalities and other bodies from getting poor work? Would it not in commercial practice lead architects, engineers and owners to search in suitable directories for the proper firm or company to do their work? Could not subcontractors be classified in much the same way, and would not this react favorably upon the buying from manufacturers and in the treatment of labor?

Unemployment relief

AS A MEANS of public benefit the construction industry is in the front rank. It provides more comfort, is more adaptable to intelligent use as a means of equalization when general industry goes up and down. That it has never been intelligently so used is one of the black spots in the industrial set-up of the country. Those economists or bankers or whoever are presumed to be the sages of industry have never found time to formulate the necessary rules. Because construction has not been used intelligently during this present depression, many will conclude that it cannot be so used.

Another trouble is that in the discussions in the last ten years it has been so frequently stated that public works could be used in part to relieve unemployment, that it has got into the minds of many people that construction could relieve all unemployment. It is probable that no single industry can do so. Each can do only its proportionate part.

Many still believe that a construction program brought into being six or eight months ago would have brought us out of the doldrums and perhaps drawn a line across the bottom of the curve of the depression.

Slow progress observable

ALL THINGS are in evolution. Many men have made honest efforts to get together the elements of construction and to create an interrelationship that would tend to stabilize and prevent demoralization. Each such effort has made its impress. Those men have not labored in vain. They have been the contributors to evolution, whereas those who have simply done their own business have been the quiet recipients of whatever there was. Those men, whether architects, engineers, contractors, subcontractors, manufacturers, dealers, mechanics or laborers, who made the conscious effort gave future generations more nearly the advantage of having a composite view of the entire industry than did their predecessors.

Every individual who makes any part of construction his work will find life more worth living when, as and if collective thinking and collective action lead to the establishment of rules of action—*the ethics of the industry*. It is believed that no national association representative of construction can hope to attempt and achieve this idea without the expenditure of large sums of money. Construction is composed of a great many entities, each sovereign or individualistic or what-not; to reach, control, stabilize and (if you please) discipline all of them requires tools, means and agencies that cost money.

The best brains for collective thinking are available. They will be given without stint so long as such giving does not apparently take one away from one's own immediate or life-chosen task. But to translate this collective thinking into effective rules of action will require all the agencies available for such purposes, and these in turn can only be acquired by paying the money price therefor. The construction industry so far has been totally unwilling to pay the price. So long as it remains unwilling, the construction industry together with those in it will continue to say, "Quo vadis?"

Stabilization in the Building Industry

An outline of the factors that now make building swing from feast to famine, and a suggestion as to the most promising lines of progress: study of building needs, and financing by the industry itself

By Robert D. Kohn, President, American Institute of Architects, New York, N. Y.

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ONE OF THE significant forerunners of the economic collapse in 1929 was a sharp decline in building, which began long before that year—for building as a whole in 1928, for housebuilding as early as 1925. The deeply depressed state of the building industry that has continued ever since raises the question of whether it is possible to stabilize the industry, which Robert D. Kohn here discusses. It is the most urgent question in the field of construction and one of the most urgent in the entire economic field.

We are greatly overbuilt, it is often said. But Mr. Kohn points to certain definite needs for building that exist today, though they are not attractive to the speculator and the banker. Searching study of such needs is one direction of progress. The problem of finance, next in order, may be capable of solution by self-financing of the industry. —EDITOR.

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CAN THE building industry be stabilized? This question is asked by many at this time, when millions of capable and willing workers are idle. It leads at once to other questions: What does stabilization mean? Could it be secured in any measure apart from the stabilization of all of industry? How would we go about it? Can anything be accomplished right now?

The frightful complexity and dire nature of the problem comprise a challenge. In this period of almost complete stagnation and disruption it is natural for all of us to look around for some way out of the mess. Under such circumstances even the most humble offering toward a solution is justified.

Stabilization is a word to conjure with. But can we define it? Probably not—but at any rate, we may be able to agree on the essentials of a stabilized industry and then think out what we would have to do to bring them into effect, what more it would require of us than we do now, what restraints it would place upon us, what more intense concentration on our own particular function, but informed by a larger viewpoint and understanding of the whole initiation and procedure of building.

Someone may say that stabilization is impossible in any one industry, unless all the other industries put themselves to the same task of leveling the peaks and depressions of demand and supply. They may say that building follows the business cycle and that business is the result of worldwide conditions. They may say that stabilization in the construction industry is particularly difficult of approach because as an industry it is dependent on the orders of other industries or speculative interests. Both objections may be partly valid without being entirely so.

We may find that there always have been needs for building, which industry and speculation have never sensed or been willing to undertake.

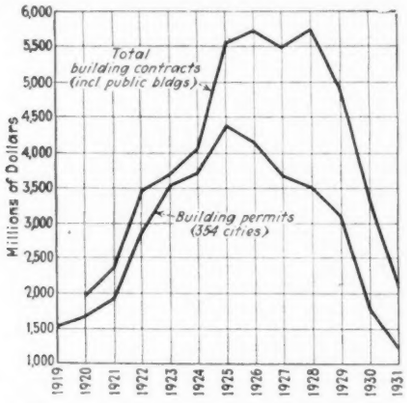
We may be able to create independent agencies, which will guide the flow of capital into building construction.

In any case, we cannot find a route toward a desired end nor decide if there is such a route *unless* we can visualize that end, even if only in sweeping generalities.

A working definition

WE MIGHT DEFINE a stabilized building industry as one that enjoys a fairly steady demand for its services and can command the capital necessary to carry out this demand; on which conditions (neither feast nor famine) the industry could then base an attempt at an intelligent measure of its scale of production and distribution of materials and machinery, the training of its technicians to design, and its craftsmen to work these materials, of its contractors and subcontractors to assemble and guide the process of building; and from which it could also deduce the scale of enlistment of all of these classes of workers, masters as well as men.

It is obvious that under such conditions all of those properly engaged in building would be able to find a worthwhile productive life within the industry, untroubled by fears of dependence in old age. This ideal is probably quite inadequate, but it may serve our purposes. If we know the port we want to steer for and can find our compass, it does not matter if we are inexact or incomplete in the description of conditions in that port. Just now the construction industry needs to know which way it should be steering. We know some of the defects in the vessels that make up the old fleet, some sailing one way, some another, sinking each other in collision or (as at present) lying idly at their wharves. If we know at least what kind of a port we would like to enter eventually, that much is gained.



Building has dropped to little more than a third of its peak volume, disorganizing the industry.

Accordingly, we have described a stabilized construction industry, firstly as one that has a fairly even demand for its services, and secondly as one that has the money to be able to carry out those services. All of the rest will naturally follow on those primary conditions. Materials, labor and technique could all be fairly balanced if the demand line for construction (barring emergencies) could be reasonably straightened out and if finance for construction could be freed from its present-day arbitrary (and frequently uninformed) individualistic control.

We may as well acknowledge at once that no one industry can free itself to any great extent independently of all of the others. None the less, the study of this problem in our industry will serve a purpose. We are trying to find a way out for ourselves in terms of a general principle; perhaps the other industries are also looking for their route of advance. In the end these routes may converge and the principle thereby be established.

Building needed now

THE ESSENTIAL conditions of stabilization, a steadied need for construction and adequate financing for it, cannot be met by waiting for the old individualism to re-establish itself in power with all its unreasonable promotion of highly profitable construction on the one hand, and its wicked neglect of less profitable but socially more important work on the other. It is bromidic to say that the building industry (like everything else) has always been financed to produce only what promised to be most profitable. And we know today to our sorrow that the judgment of these financiers was not always of the best.

A conservative builder recently remarked: "Some day we will require the issuance of a certificate of necessity for every new building that involves the investment of the public's capital, just as the Interstate Commerce Com-

mission issues a certificate before a railroad may build a branch line or parallel another road." What kind of building construction would be recognized today as justifying a certificate of necessity of this kind?

Is there really no need for any kind of construction this year? What nonsense! There are endless buildings that could be certified as being necessary. It will suffice to mention two examples of certificates of necessity that might be issued on the basis of real need, rather than on the opinion of frightened bankers: (1) the reconstruction and rebuilding of the blighted areas of our cities, residential as well as business and manufacturing; and (2) decent housing for lower-paid wage-earners. Neither of these kinds of building operation has attracted the speculator, and neither has interested the bankers.

Housing for workers

NEW HOUSING has never been provided for certain elements of the population. It did not pay, or it did not pay so well as housing for certain higher-income groups, and the risk was too great. But even if it is still impossible to produce housing with any profit for the poorer-paid range of workers, the low prices of materials and workmanship have made it feasible now to build for a new income level that includes many thousands more of our citizens in every city and state. Whatever the form—semi-detached, houses of the row type, or multiple dwellings—if it be produced in large-scale operations, decent housing can be produced for these people now.

Three things are needed: advanced legislation of the kind provided by the New York and New Jersey laws, knowledge based on experience, of how to do it, and the necessary funds. We have in the building world people who have some of the knowledge based on experience of such work done in a few places, but we must study the needs all over the country; information as to the necessary legal changes could be disseminated. But will the banks provide the funds? As far as we know they will not. They are already heavily involved in mortgages on much of the older and less desirable types of buildings, and they are afraid of the competition that would be created by new and better housing built at present low costs. After all, bankers are traders in money. Though most of them are generous to charity, business is business.

Lines of progress

THERE ARE probably much better illustrations, but the one we have cited seems to point the way. That way lies in the direction of the collection of a body of knowledge permanently available and constantly renewed as to actual needs for building construction (as against purely fortuitous or definitely speculative action) and the creation of agencies through which financial backing can be made available at all times and in reasonable measure to build to meet these needs. It ought to be possible to indicate some few immediately possible and practical steps to be taken toward this goal, even though we are fully conscious of those many more remote and more difficult things to follow. The immediate objectives are *more information* and *ways and means*.

As to Information—No one will doubt the value of the information that a united building industry could gather as to the necessity for improvements or new developments. In order to gather such knowledge as to the real needs for buildings, we of the industry must know much more than we do about ourselves, of our abilities, of our serious lacks, and we must find more effective means of using what we already have in the way of technical and material resources. To do this each group in the industry must adjust itself to function better as part of the whole producing group.

We have already made a few first moves in this direction. The local building congresses in a dozen cities (there ought to be hundreds) are mediums through which there will develop in time such an understanding based on function. The recently formed Construction League of the United States is to serve as a national center in which this same thing will come about with all the national professional and trade associations of the industry. In these two movements we can speed up the process of laying that foundation of understanding on which we can build the framework of a new kind of a closely knit construction industry.

But there is much to be done even while we work toward it. The individual worker, be he master or man, must change his point of view. We are still, most of us, in the frontiersman state of development. We think out our work (what shall we do and how shall we do it?) as if all of us could mentally clear our own forests, build our own shelters, make our own gardens and our own fences to keep out the savages beyond the clearing! It is not alone the building-trades craftsman who gets all he can for himself and cares little for what happens to the men of some other craft, much less his boss. The men who own brickyards or steel mills, those who build our roads or our skyscrapers and those who design our cottages, our museums and our bridges are each (psychologically) frontiersmen of their own particular function. The first step toward gathering the knowledge on which the industry can act is to break down the isolation of the parts of the industry; it is to spread the doctrine of industry interrelation and interdependence.

In such integrated groups as we have mentioned, in every other forward-looking industry organization, and through committees that include representatives of every function, we can start the process of getting at the facts—a new kind of facts. We must find out what kinds of buildings are vitally needed in the sense of being socially desirable—for the good of our people and for the good of our communities. We must start to find out the causes leading to obsolescence, the reasons for the abandonment of whole districts in almost every city, the effects of such abandonment on taxation and the consequent cost to the rest of the city. We would have to discover the economic values that could be created by suitable improvements, by reconstruction, by the replanning of streets and districts and regions or their total abandonment in favor of new regions.

A self-financing industry

WHEN the facts are known as to real need, then the ways in which most of them can be carried out will also be discovered. The building industry itself will come to be the initiator of projects of building, as it could be on its already extensive knowledge and experience. With rare exceptions it has been the hired man of the process of building. We have done what others have told us to do and are sitting idle now because we wait until some outsider thinks he can make money by starting something in the way of construction.

But to obviate this impasse we must understand more about the former flow of capital into building. We must see if this can be guided or controlled so as to make it available for the more needed development. We must also start at once to see if the immense resources of the building construction industry cannot be made available in part for needed construction without waiting on the ordinary sources of finance.

Can we not create our own financing units? We have the materials and the knowledge of how to use them; cannot the second largest industry of our country coordinate the efforts of its constituent parts, agree on what is to be the goal and provide not alone the materials and management but also the money for labor? We can surely find a way to build up an investment trust of our own to which we can bring the skill and knowledge of the industry. It could be made safe because of the infinite diversification of the interests allied with the construction industry.

Since the fall of 1929 there has been a continuous cry for relief from unemployment through the creation of jobs on public works of all kinds. Quite correctly the state and federal governments have been urged to have plans prepared in advance for public works so that such projects will be ready to be carried out in depression periods. But the total amount of public works in normal times is insignificant compared to the total volume of private construction. What have we of the building

industry done to collect the information and prepare the plans on which needed private building (temporarily of a less profitable nature) may be put into work in a time of depression?

We can get started right now on doing certain things that will be helpful in our present emergency, yet will also be steps in the direction of a more stabilized building industry. We can coordinate our efforts more closely; through the building congresses and similar joint organizations we can become more enlightened in our relations with those others whose work is as essential to building as is our own; we can get at the facts regarding real needs for building work, and we can find a way to finance some of them.

For us here in America the way out of our present uncomfortable mess, which is the result of unrestrained acquisitiveness, is through some process that will take advantage of the qualities of our virtues rather than the qualities of our defects. And our colossal asset in this sense is the originality and resourcefulness of our own American people, and these must be relied on and can be relied on to build for a new order of things—not only toward stabilization but toward a new kind of yet-untried democracy—one founded on function. There exists a wonderful opportunity to try that out in this building industry of ours.

Labor in Depression and After

With 62 per cent unemployed, the building trades are the most severely affected of the industrial crafts—Wage losses and their effects—Economic planning our next great field of engineering

By William Green, President, American Federation of Labor, Washington, D. C.

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PARTICULARLY in the field of construction, industrial recovery and stabilization is so intimately related to the situation of the worker that the events of the past two years demand full consideration of labor's experiences. In the present article William Green, great leader of labor, shows that the depression has borne most heavily on the wage earner and the small-salaried employee; that the building trades have been hit with unexampled severity; and that elements of unbalance remain in our industrial system, which call for large-scale economic planning on an engineering basis. —EDITOR.

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WITH ONE-SIXTH of our population either out of work or dependent on someone out of work, unemployment has become a business problem of major significance. A conservative estimate placed the number out of work in the first part of January at 8,300,000, including wage earners, salaried workers, farm hands—everyone seeking work; counting families, well over 20,000,000 people are concerned. The human need told in these figures is appalling; we cannot think of it and keep our peace of mind. But we are concerned here not with the problem of relief, but with the statement of facts that will clarify the fundamental economic significance of these figures.

In recent years the wage-earner group has come to occupy a totally different position in the economic life of this country. Before 1920 mass production was in its infancy, but since 1919 the trend has been toward large-scale production. Mass production requires mass buying, and industry thus became dependent on workers' buying to an extent never before realized. In 1919, for instance, few wage earners had automobiles, telephones or radios; the moving-picture industry was only partly developed; electrified homes were not at all usual among working groups. But in 1929, when only nine million of our twenty-nine million families were not wage earners, it is clear that most of the 23,000,000 passenger automobiles registered were being driven by wage earners, most of our 20,000,000 electrified homes were occupied by wage earners, a large part of the 12,500,000 domestic telephone customers were wage earners. And doubtless many of the 12,000,000 radio sets in use in 1930 belonged to wage earners. The motion-picture industry's 17,000 theaters throughout the United States have an average weekly attendance of nearly 100,000,000, most of whom are wage earners.

Considering all consumer industries, the residential building industry and such services as street transportation, it is clear that they depend on wage earners for the bulk of their business. Wage earners and small-salaried workers received 54 per cent of the entire national income; but they buy far more than 54 per cent of the consumer product, for with their families they form 80 per cent of our population. Almost all of their income goes directly to buy goods and services or rent homes, while the surplus income of the well-to-do is saved or invested and furnishes credit and capital for the expansion of industrial activity.

What has depression done to wage earners? How has it affected their buying power?

Let us take first the construction trades, one of the nation's key industries. Figures showing the number of building-trades workers are rough estimates, but they will give an approximate picture. It is estimated that about 2,000,000 wage earners are attached to the construction industries. Trade-union reports show 62 per cent out of work in the building trades at the beginning of 1932, and it may be assumed that this figure roughly represents the industry, although unemployment may be higher where workers do not have the protection of their union. We may estimate, then, that about 1,240,000 building tradesmen were out of work at the first of January this year.

Even in normal years unemployment in building is high. One particular bricklayer, who kept records of his work and wages for seventeen years, was out of work on the average of ten weeks a year; as he was a good workman his record is probably above the average for building tradesmen. In fact, in 1928, the peak year of the recent building boom, building-trades unemployment, as shown by our figures, average 26.6 per cent—nearly fifteen weeks. In the depression years of 1930 and '31 it rose rapidly.

The rise began in the fall of 1929 and has continued to the peak of January this year. The graph, Fig. 1, (from union reports to the American Federation of Labor for 24 cities), shows the high level of 1930 as compared with 1929, and the still higher level of 1931. In 1929 unemployment in building averaged 25.3 per cent; in 1930, 39.8 per cent; and in 1931, 51.7 per cent. *Unemployment in building has been more severe than in any other group of trades*, except such professions as that of musicians, where displacement has effected thousands.

Unemployment *for all trades*, again for 24 cities, is shown by Fig. 2. It is not as high as the building trades. In 1929, the peak year of the industrial boom, unemployment reached its lowest figure, averaging 8.2 per cent out of work; in 1930 it increased to 14.5 per cent; in 1931 to 19.1 per cent; by January, 1932, unemployment had risen

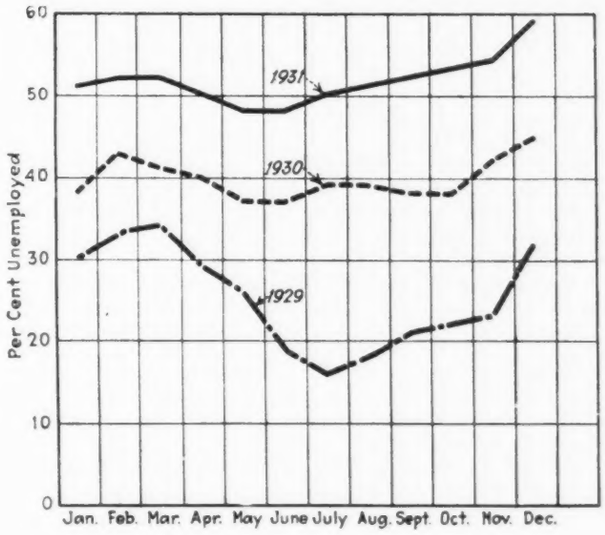


Fig. 1—Building-trades unemployment increased in 1930 and still more in 1931. At the beginning of 1932 it reached 62 per cent, which is higher than in any other industry.

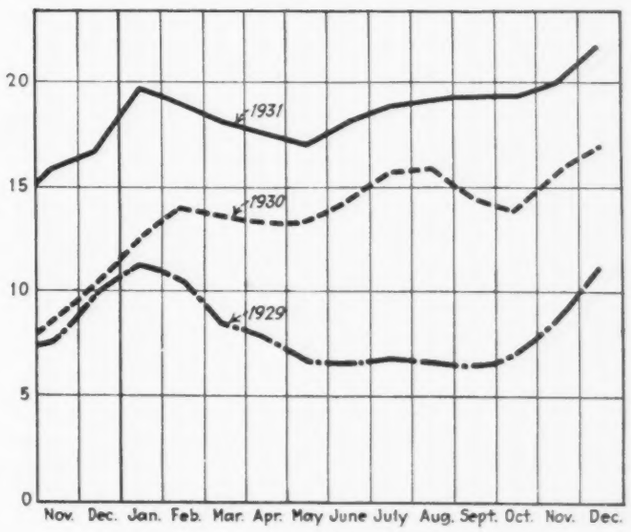


Fig. 2—Unemployment in all trades grew from 8.2 per cent in 1929 to 23.1 per cent by January, 1932, according to figures for 24 cities and some 800,000 organized union workers.

to a new peak of 23.1 per cent. This figure covering some 800,000 union members, is unquestionably lower than for unorganized workers.

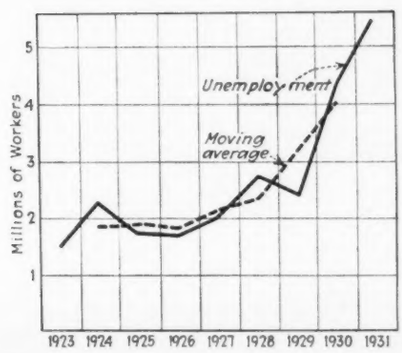
Effects of wage losses

BESIDES the human deterioration that comes with long periods of idleness, unemployment means a huge loss of buying power. We estimate that in 1931 the buying power of wage earners was below the 1929 level by eleven billion dollars. More than two-thirds of this loss is from unemployment, and much of the remaining third is from part-time work. Taking account of the change in prices and the portion of this loss that would come out of house rents, *the wage decline means a cut of 16 per cent in the entire retail trade of the country.* As this loss is reflected back from consumer to producer industries, it is magnified and becomes a powerful depression force.

The wage loss this year has been seven times the total liabilities of banks that have failed (liabilities ($1,475,000,000) and fifteen times the liabilities concerned in business failures ($729,000,000). It has been one of the chief factors in the downsweep of business. Loss for worker customers has been a blow to automobile manufacture, one of the key industries; passenger-car production was 59 per cent below the 1929 level. The loss of automobile orders has been one of the chief reasons for the decline of steel production. The motion-picture industry has suffered severely this year from loss of worker customers. Such illustrations might be multiplied indefinitely.

Not only has the wage loss cut seriously into trade; it has reduced living standards drastically. It was estimated by Prof. Paul. H. Nystrom of Columbia University that even in 1929 some 20,000,000 Americans were living below the minimum standard for health and efficiency. This depression has dragged at least 20,000,000 more below the poverty line and reduced those who were living in comfort to minimum standards. Hardly a worker's family has escaped. In addition to their own income losses, workers bear the burden of caring for the majority of the unemployed; for relief, public and private, reaches only a minority of those whose support is cut off, and the rest are supported by relatives, friends and neighbors, or borrow from stores, landlords and employers. This additional expense further reduces living standards.

Fig. 3—How unemployment grew during industrial expansion, as shown by figures of National Bureau of Economic Research and A. F. of L.



Constructive policies

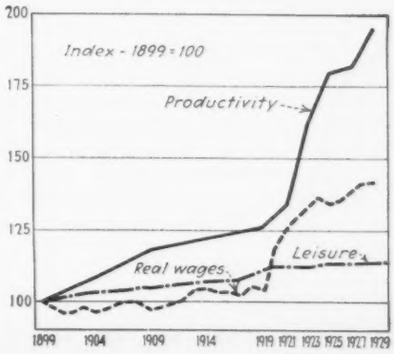
HOW MUCH of our loss in living standards will be permanent? This is a crucial question, for on its answer depends in large measure our ability to rise out of depression and work back to prosperity.

The effort to prevent wage cuts was a far-sighted and constructive measure. In spite of the recent epidemic of wage reductions the wage truce has preserved standards far better than in previous depressions. Reports for manufacturing industries by the Department of Labor during the 1921 depression, and the present depression show the striking difference in wage liquidation; in 1921 wage cuts were drastic and came at once. In 1930 wage levels were held with small change until nearly the end of the year. In the year 1921, for every 100 firms reporting to the department, there were 92 wage cuts; in 1932 there were only 24 per 100 firms reporting.

In building trades also wage levels have been held with little reduction. The record of union wage scales in May, 1931, compared to May, 1929, (Department of Labor) shows an average rate of $1.43 per hour in 1931 compared to $1.35 in 1929, the increase compensating the reduction in hours. The average hourly wage rate for all union workers shows the same trend: 1929, $1.20; 1931, $1.25.

This maintenance of the wage scale has saved millions of dollars to American industry. One has only to read the history of past depressions to note the striking difference in relationships be-

Fig. 4—During a 30-year period a steady lag of wages behind productivity is discernible, indicating a growing unbalance of economic forces.



tween employer and employee. Other depressions have a long record of strikes and industrial warfare, but in this depression such strife, more costly than thousands of dollars in wage payments, has been noticeably absent. Employers who avoid wage cuts have kept the good will of their work force—an asset which is worth millions though not set down in the balance sheet.

Return of the building industry

RETURN of the building industry depends on making construction a safer and sounder investment, and the return of the ability to pay rents and buy homes. Holding wage levels is one of the strongest bulwarks against further depression and a firm foundation for the start forward to better business.

To see the full significance of labor developments in this depression and their portent for the future, one must look back for a decade and trace the working of new economic forces. The period since the war has been a creative age, mechanically at least, and has given birth to dynamic changes. First, the economic world had to adjust itself to the return of peace-time trade and shift back from war markets and the insatiable war demands to a normal basis of activity. America, finding itself equipped to produce in large quantities for a vanished foreign market, had to develop a home market for her trade. Other world changes contributed: South America and Russia entered the field as producers of raw materials; world production outstripped world consuming power.

While this overproducing capacity in raw materials was developing in the world at large, producing capacity in America industry was also growing at a rapid pace. By 1929 it had outstripped our consuming capacity to such an extent that a committee of engineers stated that, "Our industries were equipped to produce 50 per cent more than could be consumed."

Producing power and buying power

THE RELATION of worker buying power to producing power is important: the flow of money into wages represents the return of wealth created by industry to consuming channels. In the period from 1919 to 1929 the producing power of the average wage earner in manufacturing industry increased 50 per cent (in terms of the quantity of product produced); that is, work that took three men in 1919 was done by two in 1929. But workers' consuming power did not increase proportionately, for real wages in manufacturing (wages in terms of the goods they would buy) increased only 25 per cent in these ten years. This is a significant development.

Developments in other industries were similar. And while our consuming power was falling behind, the surplus wealth created by industry was turned into channels where it accumulated as savings and was reinvested to increase industrial capacity still further. In 1919 there were 65 persons in the United States with incomes of a million dollars a year or more; by 1929 the number of these "millonaires" had increased to 513—nearly 8 times as many. The total income paid to persons receiving more than $100,000 a year was $900,000,000 in 1919; by 1929 it had increased to $4,300,000,000. The average income of factory workers increased by $165 a year, or 14 per cent, in these ten years, while the average income in other groups (represented by U. S. income tax figures for incomes over $5,000) increased by $2,933 a year, or 22 per cent. We were not taking care that the income from our industries was distributed so as to build up consuming power for our industries.

Unbalance remains

THIS UNBALANCE of income distribution has not been corrected in depression, for unemployment, wage cuts and part-time work have so cut into workers' income that their loss has been great, while divided payments to stockholders have been maintained out of industrial surpluses with comparatively small loss. Dividend payments in industrial firms for the year 1931 had fallen only to 1927 levels (Standard Statistics Co. estimates for 550 firms). Total wage payments in manufacturing have fallen below even the 1921 level and below any year of which we have record since the war. Nevertheless the maintenance of wage rates has been a step in the right direction and has prevented the deflation from going farther still.

Another maladjustment that has contributed to the unbalance of economic forces is in the field of work time. Modern machinery has greatly reduced the work time necessary to supply the nation's needs in goods and services, but hours of work have not been reduced in proportion. In 1919 the average work week in manufacturing industries was 52 hours. By 1929 machinery and new technique had so reduced the work time necessary that work that took 52 hours in 1919 could be done in 34. Two men could do the work of three, and the consequence was that, although the volume of production increased 42 per cent in these ten years, 200,000 workers lost their jobs in manufacturing industries. Employment in manufacturing was 9,000,000 in 1919 and only 8,800,000 in 1929. This decline in employment because of technological improvements has affected a number of other industries, so that jobs are disappearing in at least half of the nation's fields of industrial work. The other industries are not increasing their production or services fast enough to compensate this loss of employment, and the result is that for the United States as a whole, according to our estimates, supplementing those of the National Bureau of Economic Research, the average number out of work in normal years increased from 1,400,000 in 1920 to 2,400,000 in 1929 (Fig. 3).

The working man wants a chance to work; he feels that the opportunity to earn an honest living is his right. And indeed how can he enjoy the rights of life, liberty and the pursuit of happiness guaranteed him in the constitution unless he has the right to work? The right to work for wage earners implies responsibility to provide work on the part of employers.

At the present time (winter of 1931-32) a careful estimate shows that there actually is in the United States only 35 hours' work a week to be done if every man and woman who wants work has a job. Would it not be better to employ all our 30,000,000 wage earners on a 35-hour week than to have 21,700,000 at work for varying hours up to 60 a week, and 8,300,000 unemployed?

Engineering on a national scale

TO COORDINATE these unadjusted forces is a task of engineering on a national scale. We have tackled problems in the individual plants and conquered them. Here is a problem that requires coordination of many plants in one industry, of many industries in one nation. We can progress slowly toward this goal, building up from the beginnings we have made. The field is untried, and as yet we have not even the necessary guideposts of statistical measurement. One of the first steps will be to secure the statistical data we need and link our chains of figures together until they give an interpretative picture of the whole, which may furnish a basis for action. We need more complete figures on employment, wages, hours of work; we need figures on man-hours in industry to show how much employment is needed. Credit should be balanced against work to be done, production against consuming power.

Coordination the problem

These are a few of the measurements we shall need as tools for economic planning, our next great field of engineering. These problems of coordination are of the greatest interest to labor, since working men bear the brunt of the suffering when readjustments are made by business depression. We are eager to see economic measurements become the basis for changes in business activity so that business need not be dominated by hopes and fears, hunches and guesswork. Also, since we have experience in working together through organization, we are eager to see a mechanism that will make it possible for individuals to cooperate for the benefit of the group and prevent the tragedies that happen when all act separately.

Municipal Securities Today and in the Near Future

Municipal expenditures, debts and shrinking income as well as an unsettled bond market make financing difficult—Prime municipal bonds likely to recover before general bonds

By W. Barrett Brown, Manager of Ratings, Moody's Investors Service, New York, N. Y.

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WHAT has happened in the municipal bond market can only be understood by going back to the World War. At that time public improvements were discontinued because of the shortage of labor and capital, while manufacturing facilities were vastly increased. Thus, after the war the country had a huge amount of public work on hand and tremendous industrial capacity. The one stimulated the other to an extent, but the principal momentum came from the "new era" of mass production, high wages and the American standard of living. That program left the nation at the peak in 1929 with swollen corporate capitalization, tremendous over-capacity for producing commodities and finished goods, and huge individual and public debts. The subsequent deflation reduced the value of ownership and enhanced debts.

The debt of all civil divisions in the United States, exclusive of the federal government, is currently estimated at $17,000,000,000. At the close of the World War it was about $6,000,000,000. This huge increase took place in a period when the federal debt fell from a maximum of $25,500,000,000 to about $16,200,000,000 a year and a half ago (recently again increased). Notwithstanding the extensive debt retirements by the federal government, the American people are as heavily indebted publicly as they have ever been. This is a real burden.

What are the reasons for the huge debt accumulation? They include the citizen's neglect of public affairs, the carelessness of political administration, the obsolete machinery of government, boom financing of improvements and collapse of real-estate booms. But not the least important is the demand of the taxpayer for public improvements.

The taxpayer wanted elaborate highway systems, larger and more modern schools, better hospitals and more pretentious public buildings. These things were procured with borrowed money, most of which is still owed. Many of the improvements could be undertaken today as a fraction of their book cost; others represent enlargements that are not yet needed and may not be needed as soon as was expected. Meanwhile the taxpayer in the majority of cases has suffered a sharp reduction in income. His property is worth less than it was in 1929; the tax rate often is higher.

To complicate matters further, the municipal bond market has been unsettled, and bank credit is not easy to obtain. The typical municipality has never had large cash reserves. It has financed improvements with bond issues and has raised current funds through bank loans. In the present bond market many municipalities have been forced to use cash on hand to continue improvements. They have already financed their anticipated taxes to the limit. Local banks in many cases have been closed; in other cases they can buy no more municipal paper. Hence the frequent embarrassment in meeting public payrolls.

Present market conditions

WITH MOST municipalities unable to sell any bonds at all, with many large cities having difficulty with their payrolls and fixed charges, the municipal bond market is best pictured by the fact that New York City, after some difficulty, sold some three- to five-year notes on a 6 per cent basis, whereas it was able to sell 3 per cent long-term bonds last May, and on short-term paper was borrowing at 1⅜ per cent only four months ago. Philadelphia has endeavored to sell bonds over the counter to citizens. Chicago actually cannot market tax-anticipation warrants. The banks have far too little room to take up all the paper the municipalities would like to sell.

Most of our civil divisions are, in the eyes of the law, corporations. They have a certain revenue, certain operating expenses, definite fixed charges and requirements for capital improvements, not to mention current demands for unemployment relief. Considered as corporations, their best program would appear to be that followed by private corporations. Their first aim must be to balance expenditures and revenues. Revenues must be actual revenues and not paper revenues that have not been collected. The charges for bond interest and retirement are fixed and cannot be gotten away from honorably. Therefore, if income has fallen, *expenses must be reduced*. Apparently, the first attack is made upon improvements. Then attempts are made to improve administrative efficiency. These things failing, as they frequently do, talk is then heard of payroll reductions.

Unquestionably, some improvement work can be deferred. Some of it, from an engineering standpoint, should be continued, for abandonment leaves things up in the air. If a new highway in a congested area has been half built and reduced revenues force the work to stop, the half highway is of no use and merely congests traffic—thus, loss is sustained on the idle investment and machinery. However, money cannot be raised by imagination. If revenues do not permit it, much work will have to be deferred temporarily.

Lowered tax rates

THE PROBLEM is not simply that of balancing the budget. Unless there is a sensational improvement in business soon, taxpayers are going to demand a reduction in tax rates. Possibly the solution of this problem is a careful study of taxing methods. Steps to relieve the burden on land without arbitrarily damaging other sources of revenue may make it possible to reduce taxes without reducing budgets drastically. But the immediate problem is this: the taxpayers are crying for relief, and deferring improvement is not the answer, because those projects that have not yet begun generally have not yet been financed.

Inevitably attention will fall upon operating expenses. Some of these are very high compared to private practice. It will probably be found that consideration must be given to lowering salaries and wages for many public officials. This will be embarrassing to all concerned and will probably be deferred in many instances. But everything comes back to the unpleasant fact that our typical municipality is set up to spend a lot more money than it can possibily raise in the near future.

Until the statistical position of our municipal debts is improved by a readjustment to the actual facts of today, investors are going to be increasingly critical of municipal bonds. Until they cease to be critical and there is a broad market for public obligations at reasonable interest rates, it will be impossible for municipalities to obtain funds with accustomed ease. This means that improvements will have to be considered in the light of their immediate usefulness and the ability of the community to finance them readily.

With a general improvement in business and in the bond market, prime municipal bonds will cease to be depressed by factors affecting the general group. But it will be impossible for municipal finance to escape the effects of a general deflation when corporations and individuals have already submitted to it.

Mississippi River Work Ahead of Schedule

More than 209 million yards placed in levees in 3½ years—1931 output of 93.9 million yards beats record —Channel regulation by permeable dikes and bank revetment undertaken on large scale—Less than half of main-river levee yardage remains to be placed

By Brig. Gen. T. H. Jackson, President, Mississippi River Commission, Vicksburg, Miss.

◆

TO DEC. 31, 1931, about 104½ million dollars had been expended under the flood-control act of May 15, 1928, distributed as follows to the several major divisions into which the activities prescribed by the project and act may be grouped:

Levee construction, lower Mississippi, Arkansas, Red and Atchafalaya rivers	$48,100,000
Bonnet Carré spillway construction	6,200,000
Rights-of-way, flowage and drainage	2,500,000
Channel regulation:	
Bank protection	28,100,000
Contraction works	5,300,000
Dredging	4,800,000
Surveying, mapping, collection of physical data, flood relief and emergency levee repairs, tributary levee construction	9,500,000
Total	$104,500,000

A comparison of expenditures to date with total costs estimated by the reviewing board appointed under the act is shown in the accompanying table.

Construction

Levee Work—The unusually favorable climatic and river-stage conditions that characterized the preceding winter have recently been succeeded by stages and weather more normal to the lower alluvial valley winter months. The effect upon output has been very marked: December yardage totaled only 3¾ millions, as against about 9½ millions in November and 10.7 millions in October. Despite this, however, the year established a new record of some 93.9 million cu.yd. placed. This closely approaches the volume of levee work awarded during the year—91½ million yards. There was, therefore, an approximate balance between output and offerings.

During the past six months construction has proceeded at the average rate of about 296,000 cu.yd. a day. During the heaviest month, October, the rate was about 345,000 cu.yd. a day.

The policy has been to contract all the work that it was possible to let without prejudice to the public interest. This policy, in conjunction with improved efficiency of contractors' plant and organization and reduced labor costs not shared by the government outfits, held the yardage awarded to government machines to a total of 5 million cu.yd.—about half as much as was placed by government plant in 1930 and less than 6 per cent of the total offered to bidders in 1931. The average price at which the work was bid in by contractors during 1931 was 15.33c. per cubic yard, as against 23.12c. per cubic yard for 1930 and 23.20c. per cubic yard for the period prior to 1930.

In addition to the work considered above, about $1,500,000 of federal funds have been expended or obligated to date for the placement of about 11 million cu.yd. under the provisions of section 6 of the flood-control act, which provides for construction of levees on the Mississippi River and Cape Girardeau and upon tributaries of the Mississippi, on a cooperative basis—the government paying two-thirds of construction costs and local interests paying one-third and furnishing right-of-way.

Channel Regulation—The working season brought to a close by recent river stages has been one of unusual accomplishment in channel regulation works.

The general plan of channel regulation provides for the contraction, through accretions produced by permeable groins, of those reaches of the stream that are so wide at low water that the depths are less than the 9 ft. required under the project. These dikes ordinarily extend into the stream from one side (the convex), thus forcing the river against the opposite bank. To prevent the latter from receding and also to provide and to retain the desired alignment, bank-protection works are provided. Bank protection generally is thus, and properly, an adjunct to channel regulation, not levee protection.

EXPENDITURE TO DATE COMPARED WITH ESTIMATED COST

Item	Estimated Cost (Reviewing Board)	Expended to Date	Per Cent of Total
Floodworks, including rights-of-way, drainage and flowage	$207,500,000	$56,800,000	27½
Revetments (bank protection)	80,000,000	28,100,000	35
Contraction works	20,000,000	5,300,000	26½
Dredging	10,000,000	4,800,000	48
Total	$317,500,000	$95,000,000	30

While some bank-protection work has been in progress in the Vicksburg and New Orleans districts, the major effort has been in the Memphis District during 1931.

The permeable dikes completed and under construction aggregate about 103,000 lin.ft. (about 19½ miles). All of this work has been initiated subsequent to 1928, and about 53,000 lin.ft. was completed or initiated during the calendar year 1931.

The amount of bank protection during the six months' period, July 1 to Dec. 31, 1931, exceeded that of any prior full year under the project. The following figures give the comparison:

Bank Revetment	Feet
Placed in 1929 (fiscal year)	83,000
Placed in 1930 (fiscal year)	74,000
Placed in 1931 (fiscal year)	63,000
Placed July 1 to Dec. 31, 1931	89,000

The aggregate length of effective bank protected below Cairo is now about 167½ miles.

Dredging — The abnormally low stages of 1930 were, contrary to expectation, repeated in 1931 with consequent necessity for extensive channel dredging. About 9.8 million cu.yd. was moved, a part of which is, however, chargeable to operations in connection with contraction works. Two new and one rebuilt dredge account in part for the large expenditure for dredging to date.

Mapping and Miscellaneous Operations—Since the initiation of the project about 41,600 square miles of territory has been mapped and the data prepared for publication. The mapping program is practically completed. Of the five million dollars allocated to surveys, investigations and reports on tributary streams, a little over four million dollars has been allotted.

The Waterways Experiment Station at Vicksburg has in the course of a single busy and interesting year abundantly justified its creation.

Flood-control works

The Birds Point-New Madrid floodway is practically completed, with the exception of the degrading of the fuse-plug sections.

The Bonnet Carré Spillway structure is completed. Its side levees are nearing completion. Material is in place for a rapid closure of railroad and highway gaps through the side levees; and although the treatment of crossings is still in litigation, the situation physically is such that the spillway could be made to function in case of urgent necessity.

The Boeuf and Atchafalaya floodways are, so far as progress in construction is concerned, in status quo 1930. Litigation concerning them has, however, reached the U. S. Supreme Court with a dispatch that presumably connotes full recognition of the importance of the case and the desirability of its early settlement.

Levee work along the main river and along the south banks of the Arkansas

and Red has corrected most of the seriously weak links in the chain.

The work contemplated in the vicinity of Cairo has been completed except for a short stretch of special construction along the city front, whose completion is scheduled for the coming season.

The head of the upper St. Francis has been protected by work on the diverted Little River below Cape Giradeau.

Protection is complete from the head of the lower St. Francis district, just above New Madrid, to Caruthersville, 50 miles downstream, except for a stretch of about 5 miles along St. Johns Bayou. About 24 miles of work has been completed below Caruthersville.

In the Reelfoot district all very low levee has been brought up, and the line is in excellent shape for flood.

In the White River basin, protection of the Helena Front is far advanced and should be completed next season. Along the relatively short front of this district above the backwater area about 2 miles of levee has been completed and 4 miles is under construction.

In the upper Yazoo district a continuous stretch of about 19 miles extending southward from the head of the district at Memphis, and about 10 miles additional at Mhoons Landing and near the lower end of the district is either completed or under construction. The coming year is expected to result in continuous protection to final grade about 26 miles at the head of the district and for 17½ miles at the lower end (head of lower Yazoo district).

The lower Yazoo district now has continuous protection (completed or under construction) for a distance of about 105 miles downstream from its junction with the upper Yazoo district, and it is planned during the coming season to extend this line downstream to the head of backwater near Mayersville, Miss.

The levee line on the south bank of the Arkansas River, which protects the head of Tensas Basin, is completed or under contract for a distance of about 43 miles.

Along the Mississippi River front of the Tensas Basin, protection is completed or under construction from just below the fuse plug of the Boeuf Floodway to Lake Providence (about 53 miles), with the exception of a short stretch of about 5 miles near Grand Lake, Ark.; short stretches aggregating about 7 miles are completed or under construction between Lake Providence, La., and the junction of the upper Tensas and lower Tensas districts, opposite Warrenton (Vicksburg), Miss.; a continuous stretch of about 54 miles extends southward from opposite Warrenton; and an additional 5 miles of loop construction is under way a few miles below Vidalia, La. Plans for next year contemplate the consolidation of all stretches in the upper and lower Tensas districts (except the loop just referred to) into a continuous line extending from near the head of Lake Chicot (opposite Greenville, Miss.), to the vicinity of Vidalia, La. (opposite Natchez, Miss.), a distance of about 203 miles. In general terms, this embraces the entire Tensas Front just below the fuse plug to backwater.

Along the south bank of Red River work is completed or in progress over stretches aggregating about 27 miles.

In the Atchafalaya (Front) Levee district, which extends along the west bank of the Mississippi River from Red River to Donaldsonville, La., stretches of levee completed or under construction, aggregating about 54 miles in length, are to be consolidated during the coming season to furnish continuous protection from just below Bachelor (head of East Atchafalaya floodway levee) to within a few miles of the lower end of the district.

In the LaFourche District, which extends from Donaldsonville to New Orleans on the west bank, and in the Pontchartrain District, extending from Baton Rouge to New Orleans on the east bank, separated stretches aggregating about 22 and 66 miles, respectively, are completed or in process of completion. Only a small amount of work remains to be done in these two districts and consists principally of minor enlargement of levees that are now but slightly deficient.

In addition to the above, several stretches of levee threatened by caving banks have been constructed below New Orleans. In general, however, the lines below New Orleans are adequate without improvement.

It is estimated that levee yardage below Cairo under the adopted project will aggregate about 570 million cu.yd., of which about 113 million is estimated for protection levees in the Boeuf and Atchafalaya floodways. Of the remaining 457 million yards, awards to date account for about 256 million, leaving about 201 million required for completion of levees other than floodway protection levees. On the basis of past awards next season's contracts should cover an additional 80 million yards, which, if applied to the main-river lines exclusively, would leave a residue of but 121 million for their completion.

New Construction Tempo Being Set at Hoover Dam

All previous tunneling records smashed in driving four 56-ft. diversion tunnels—Speed in all operations surpasses most optimistic expectations—Boulder City practically completed

◆

A CONSTRUCTION tempo far surpassing anything previously known in the engineering world is being maintained in building the Hoover Dam and its appurtenances at Black Canyon on the Colorado River. All former tunneling records have been smashed in the consistent progress of 230 to 260 ft. per day that is being made in driving eight 41x56-ft. enlarged headings in the four long diversion tunnels that will carry the river around the dam site during construction and later serve as spillways and penstocks. Highways, railroads, pipe lines and transmission lines have been completed with amazing rapidity, serving to establish adequate and comfortable housing and living conditions for the army of construction forces, as well as providing means for a concerted attack on the main job and its varied ramifications. Boulder City, ostensibly a glorified construction camp, is in reality a city of the desert, springing into being with all modern conveniences of water supply, sewers, paved streets and substantial homes and buildings. The record is the more remarkable when it is recalled that bids were opened less than twelve months ago.

The contractor has more than 3,000 men at work. A railroad line has been built down Hemenway Wash to the river and thence along the side of the gorge to the upper portals of the tunnels and on to the dam site. A branch from this line taps the gravel pits 8 miles upstream from the dam, crossing the river on a pile trestle, which is expected to be carried away more than once by floods. Suspension bridges capable of carrying motor trucks are being constructed across the river near the dam to provide additional access to the Arizona operations. Permanent highways to the top of the gorge have been completed, along with equally substantial but temporary construction roads leading to the bottom of the canyon and radiating from the tunnel portals. A huge screening and crushing plant is being installed to prepare aggregates for the 5,000,000 cu.yd. of concrete required by the job. A battery of six 4-yd. mixers is being

erected to mix the concrete for the tunnel lining and for the lower part of the dam.

The four diversion tunnels total 15,905 ft. in length. Pioneer top headings, 12x12 ft., were driven from seven of the eight portals and both ways from adits, cutting the tunnels at their midpoints, as a forerunner to the main tunnel-enlargement work. Initial excavation started at the Arizona adit May 14, and driving of the pioneer tunnels was completed 234 days later on Jan. 3. All headings, including adits, reached a total of 16,245 lin.ft., involving 85,220 cu.yd. of excavation. Driving of a full-face 41x56-ft. heading started at the lower end of the outer Arizona tunnel late in October, and enlarging work of the same dimensions followed on the other seven portals. The remaining 15-ft. bottom bench will be taken out after the enlarged headings are holed through and cofferdams are built at the portals, for the final tunnel grade is below river level. Enlarged headings on one of the tunnels will probably hole through early in February. Concrete-lining work will then start early in March. Up to Jan. 23 a total of 11,380 lin.ft. of enlarged headings had been completed. Trucks from 6- to 14-yd. capacity are being used to haul the muck out of the tunnels. Truck-mounted drill carriages, handling 25 drifters, permit rapid drilling of the faces. With 20-ft. drill holes, 15 ft. of heading is being pulled with each shot. Using three eight-hour shifts, an average of more than two rounds per day is being maintained in each of the eight headings.

Boulder City

PROVIDING municipal facilities for Boulder City has been practically completed, with the water and sewer systems finished and street and sidewalk work well advanced. The sewage-disposal plant and water-filtration plant are scheduled for completion early this spring, at which time the major government buildings will also be ready for occupancy. Street-surfacing work consists of laying the various types of asphaltic pavings specified; sidewalks are concrete and gravel. The major group of buildings constituting the town at the present time consists of the contractors' housing facilities, including the dormitory and office group and several hundred small houses. The principal government buildings under construction include the city, municipal and the adminsitration and dormitory group, supplemented by 24 single-family residences. The water supply has been available with preliminary treatment since late fall, and completion of the filtration plant will provide a domestic supply of modern quality. The town has transportation facilities, both railroad and bus, together with an excellent highway connection to Las Vegas, Nev.

Contractors Learning Unity Through Hard Experience

Decreased volume of work, intensified competition and financing difficulties tend toward breaking down local isolation—The outlook for adjustment

By E. J. Harding, Managing Director, Associated General Contractors, Washington, D. C.

◆

WHAT the past two seasons meant to the contracting fraternity finds clear expression in the disorganization of bidding during recent months and its reaction on subcontracting, labor and materials interests. But, as Mr. Harding indicates below, the times are enhancing the recognition of national unity among general contractors. With this gain and a public-works program to ease readjustment, the outlook will not be discouraging. —EDITOR.

◆

CONTRACTORS have been hit severely by the depression. Decline in volume of work accentuated the ferocity of price competition. Profit margins have been wiped out or reduced to the narrowest limits. Managerial abilities are being taxed to the utmost.

In themselves the problems arising out of internal competition are not new. They have always existed, and since 1924 they have been gradually increasing in intensity. They originate in loose credit practices, irresponsibility on the part of a few general contractors, and failure on the part of those awarding contracts to examine into the qualifications of their bidders. During the past year these internal maladjustments of the industry have been brought home to all elements involved in construction.

External business conditions have also played havoc with many otherwise responsible general contracting concerns. Finances have been tied up in closed banks. Assets have been depreciated. On the other hand, irresponsible firms that operated on false credit during boom times have been eliminated from the field. The breakdown of credit unfortunately hits some responsible as well as irresponsible firms and presents new problems to organized contractors. The solution to those problems requires that ways must be found to safeguard the depleted credit of responsible concerns. It requires that the chain of cooperative credit bureaus already established be extended nationally and the plan for the creation of a sound credit structure for the entire industry be carried out in full.

Altogether, it appears that the long-time program of the A.G.C., involving the creation of a sound credit structure, sound merchandising procedure, prequalification of all contractors who desire to bid, and the general curbing of irresponsibility is essential in both good and hard times.

To sum up: the one outstanding result of the current depression has been to cause general contractors to come closer together in their national association. Local isolation has been broken down to a greater extent than ever before. Bidders go farther afield in search of work. The national aspect of problems is better recognized. It is further recognized that only national action can succeed in working out of present conditions, and that general contractors alone are unable to initiate that action.

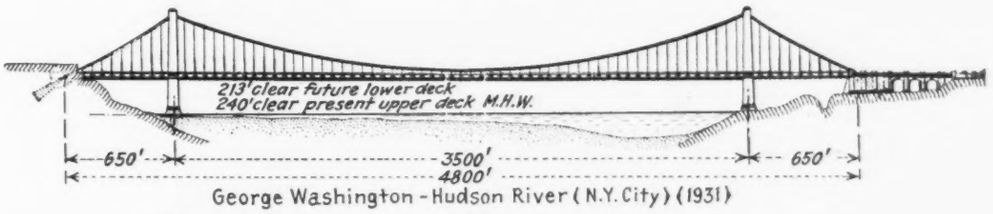
Present conditions will not adjust themselves. They must be adjusted. There are two processes for carrying out the readjustment: protection of high wages and of security values on a pre-depression basis can only be brought about by some process of inflation of currency, the final result of which will be the indirect liquidation or marking down of real values; on the other hand, continuing the present process of deflation will have the same final result.

To the A.G.C. it seems that the inauguration of an extensive program of construction of needed public and semi-public works provides the means of softening the process of readjustment. We are convinced that the financing of such a program will be less burdensome in the long run than any attempt to carry out a readjustment without such construction activity.

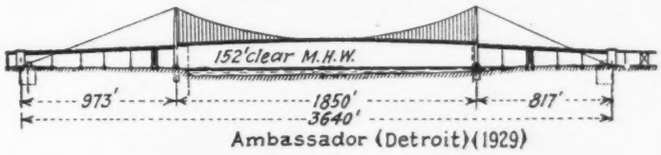
Record Long-Span Bridges

The past few years have witnessed the completion of a galaxy of large bridges. Only one famous old structure—the Quebec cantilever—has been able to maintain its supremacy. To present this remarkable development as impressively as its importance warrants we have prepared the plate opposite. On it the results of a golden era of bridge building may be seen at a glance.

NEW RECORD-SPAN BRIDGES AND SOME FAMOUS PREDECESSORS

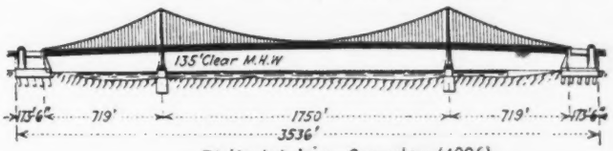


George Washington - Hudson River (N.Y. City) (1931)



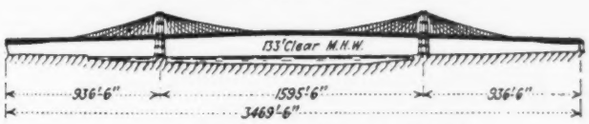
Ambassador (Detroit) (1929)

SUSPENSION BRIDGES



Philadelphia - Camden (1926)

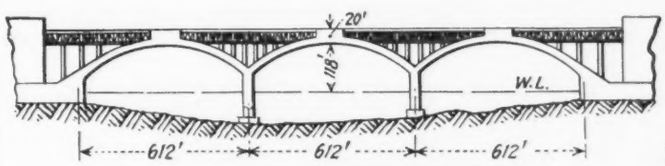
Sydney Harbor (Australia) (1932)



Brooklyn (N.Y. City) (1883)

Kill van Kull (N.Y. City) (1931)

Hell Gate (N.Y. City) (1916)



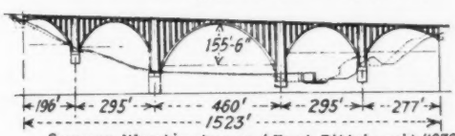
Plougastel (France) (1930)

Croton Lake (New York) (1931)
(Two-Hinged Arch)

Scales
All Steel Bridges Same
Concrete Bridges Same

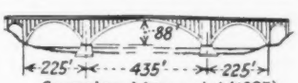
STEEL ARCHES

West End (Pittsburgh) (1931)
(Tied Arch)

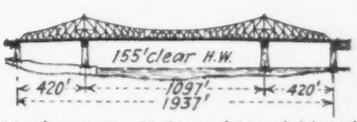


George Westinghouse (East Pittsburgh) (1932)

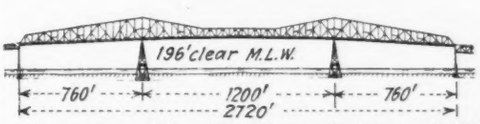
CONCRETE ARCHES



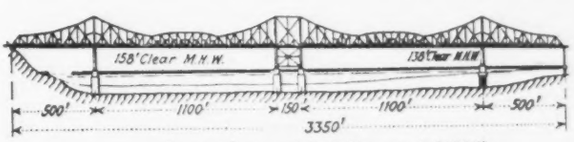
Cappelen Memorial (1923)
(Minneapolis - St. Paul)



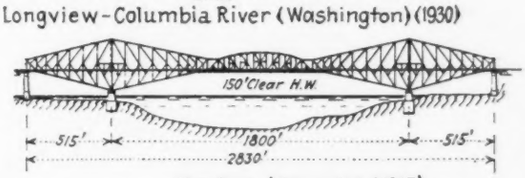
Montreal - South Shore (Canada) (1929)



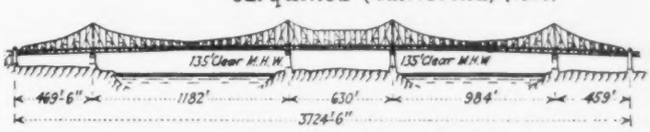
Longview - Columbia River (Washington) (1930)



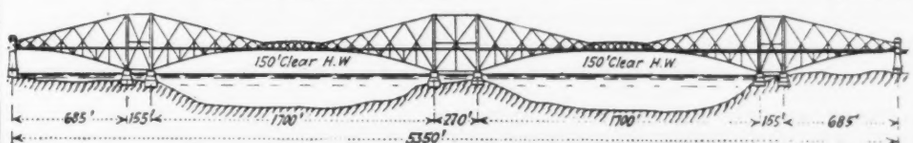
Carquinez (California) (1926)



Quebec (Canada) (1917)



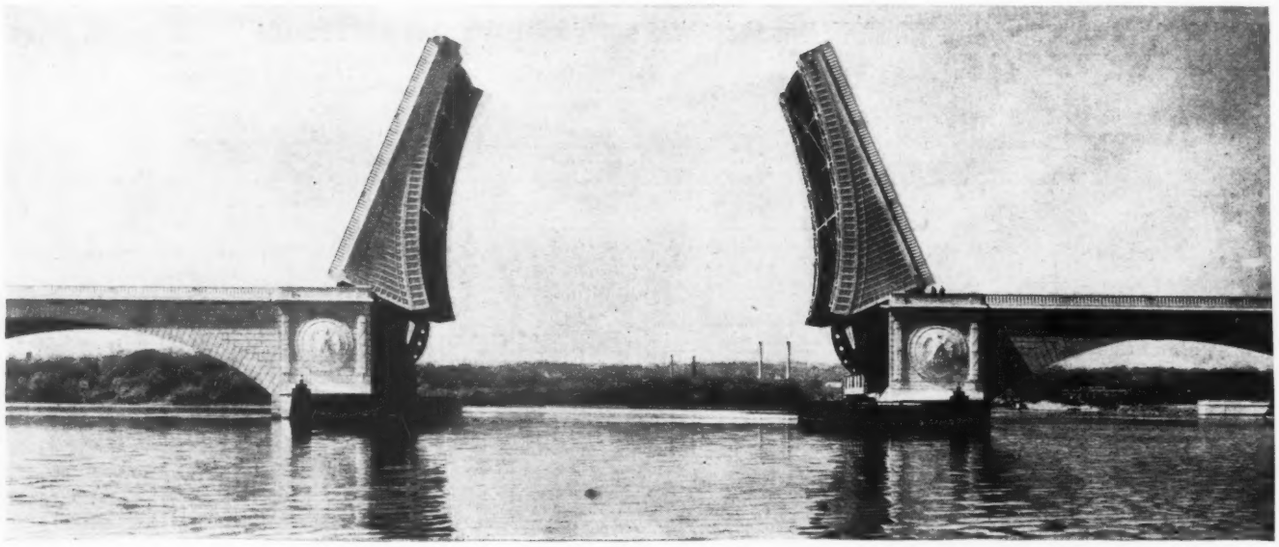
Queensboro (N.Y. City) (1909)



Firth of Forth (Scotland) (1890)

CANTILEVER BRIDGES

Engineering News-Record, February 4, 1932



The Arlington Memorial Bridge over the Potomac, at Washington, D. C., was practically completed at the end of the year. The double-leaf bascule span, providing a navigable channel opening, is faced with aluminum spandrels to harmonize with the four stone-faced concrete barrel arches at either end.

Progress Made on Large Engineering Projects

Public water supply

▶ *Hetch Hetchy Project*—The bringing in of a mountain water supply for San Francisco is in its final stages of development, and completion of the Hetch Hetchy project is a possibility for late in 1933. Because of emergency conditions, however, it has been advisable to begin construction of an emergency pipe line to bypass the Coast Range, which is now being tunneled. This 28.6-mile tunnel is about 80 per cent driven, and lining operations are under way. Its completion will permit the gravity delivery of water; the emergency line will require pumping over the Coast Range. The pipe-line section across the San Joaquin Valley, which will connect the eastern portal of the Coast Range tunnel with the outlet from the tunnels through the foothills, is well advanced and will be completed by June and used with the emergency line, later becoming part of the ultimate system when the Coast Range tunnel is completed. This line consists of a 60-in. steel pipe laid in trench. The completion of the San Joaquin Valley pipe line and of the emergency pipe line will make Hetch Hetchy water available for San Francisco; finishing of the Coast Range tunnel will complete the gravity system.

▶ *Colorado River Aqueduct* — By a five-to-one vote the Metropolitan Water District of Southern California, in September, authorized the $200,000,000 project to bring Colorado River water to Los Angeles and adjacent cities. Work is under way on final design and location studies, while legal issues are being settled in court, prior to preparations for marketing bonds. The route of the 226-mile aqueduct of 1,605-sec.-ft. capacity has been approved by the consulting board. Tunnels on the line aggregate 84 miles in 40 individual bores. The longest tunnel is 13 miles. Work is under way in getting preliminary tunneling operations started, because this feature of the work will govern the length of the construction period. The construction program will occupy about six years.

▶ *Vancouver Water Tunnel* — Shafts have been sunk and driving is under way on the pressure tunnel under the First Narrows at Vancouver Harbor. The tunnel is being built by the Greater Vancouver Water District as an important improvement of the Capilano River supply. The 3,100-ft. bore will replace the present submerged cast-iron mains extending across the Narrows and will be driven through coarse sandstone formations at a depth of 400 ft. The Capilano River project is one of the three important sources of supply for Vancouver, B. C., and the surrounding municipalities comprising the district.

▶ *Detroit Waterworks*—The intake system and river tunnel for the new supply are now complete, with the exception of a short section of shore tunnel, surge basin and the installation of some minor equipment. Part operation of the Springwells plant was begun with purchased electric power. The entire filtration plant, including the coagulation basin and mixing chamber, is ready for service, with the exception of 48 of the filters that are not yet fully equipped. One 20-m.g. filtered-water reservoir is in use, and a second of the same size is practically completed but not yet in operation. The pumping station that houses the low- and high-lift plant is practically complete. All ten low-lift pumps and twelve of the sixteen high-lift pumps are in place.

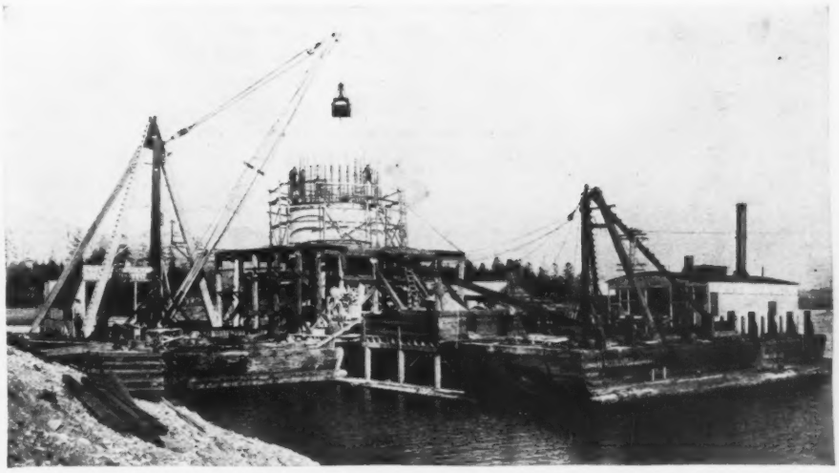
▶ *Chicago Waterworks* — Construction was continued during the year on the new 16-ft. Chicago Avenue intake tunnel. A connection between the new intake crib and the tunnel has now been completed. The Chicago Ave. pumping station is soon to be connected to the new tunnel, and the section between the pumping station and the lake will then be in use. Two additional shafts have been excavated to tunnel grades. Tunnel excavation was carried 5,000 ft. farther during the year, and 8,000 ft. of concrete lining was added. The distribution system was extended by the laying of 62 miles of water pipe, ranging in size from 48 to 6 in., and 17,000 meters were installed during the year. Experimental work on the filtration program was continued, but no definite program for plant construction has yet been established.

▶ *Moffat Water Tunnel*—In September, 1929, the Denver water department leased the 6-mile pioneer bore of the Moffat railroad tunnel to use for diverting water from the headwaters of the Colorado River to the city. The estimated cost of enlarging and lining the tunnel to adapt it to water-carrying purposes, together with inlet and outlet work, is $2,870,000. Up to the present time the water department has installed 3,363 ft. of steel lining. The Moffat Tunnel Commission

had lined 1,501 ft. The diameter of the finished tunnel is to be 10½ ft.

▶ *New York City Water Supply* — Controversy over New York City's plan to go to the Delaware River for additional water ended in May by a Supreme Court decision sustaining the city's right to divert water from the Upper Delaware (within limits set by a special master appointed by the court). No actual construction on the Delaware River project has been started, but borings have been made for a new tunnel connecting the Kensico and Hillview reservoirs, which will be required for the new supply. Work upon a second tunnel from Hillview reservoir under the boroughs of Bronx, Queens and Brooklyn to reinforce the city's supply from the Catskill tunnel, let in October, 1928, is practically complete, and the lining is well under way. This latter tunnel has a length of 20 miles.

▶ *Boston Water Supply* — Construction of the 14-mile Wachusett-Coldbrook tunnel, the first unit in the project to go to the Ware and Swift rivers for 191-m.g.d. additional supply for Boston, was completed in the summer of 1930. In April, 1931, contract for the 9.5-mile Coldbrook-Swift River tunnel was let. Work on this tunnel had been postponed pending a decision of the Supreme Court as to the right of Massachusetts to divert water from the Connecticut River (the Ware and Swift are tributaries). A decision favorable to Massachusetts was given in February, 1931. In August of last year a contract was let for the stream-control works at the main dam of the Swift River reservoir, including a 30-ft. diversion tunnel 1,000 ft. long. Exploratory caissons are now being sunk at the site of the main dam, and at the site of the dike, a structure of similar dimensions, for the Swift River reservoir.



Sinking a 24-ft. caisson for the downtake shaft of the 3,100-ft. tunnel to be driven under First Narrows of Vancouver Harbor by the Greater Vancouver Water District.

▶ *Albany Water Supply*—The first of three stages of the new gravity water supply for the city of Albany, N. Y., was completed during the year. This includes Alcove dam and reservoir on Hannacrois Creek, a tributary of the Hudson, a diversion dam and tunnel from Basic Creek to the Hannacrois watershed, about 20 miles of 48-in. cast-iron conduit, a 32-m.g.d. filtration plant and a distribution reservoir at Loudonville on the outskirts of the city. The new supply will replace the one pumped from the Hudson River. The second and third stages will be built as required.

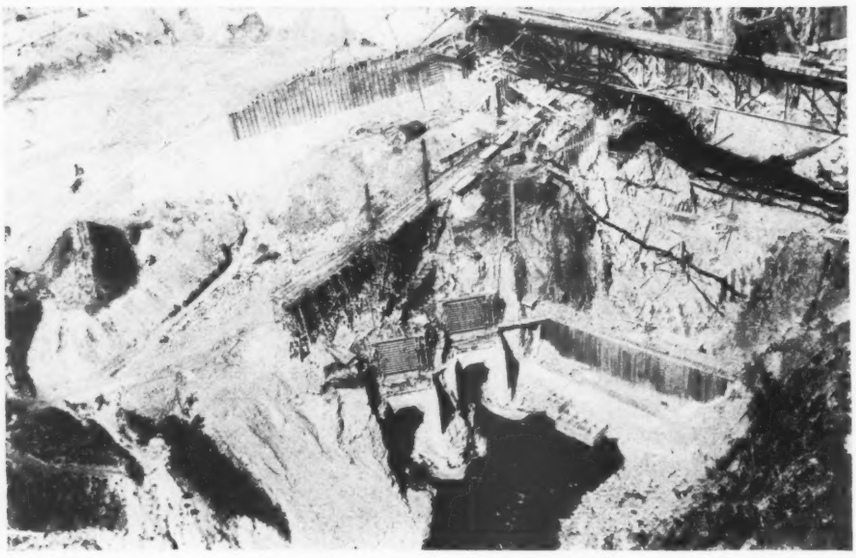
▶ *Cobble Mountain Dam*—The highest earth-fill dam in the world (250 ft.), being built at Cobble Mountain, near Westfield, Mass., by the Springfield, Mass., water board, was practically complete at the end of 1931. A total of 1,383,000 cu.yd. of fill has been placed in the dam by the hydraulic method. Nearly 400,000 cu.yd. of rock fill was required in blankets on both slopes of the earth fill and in a diversion dam forming the upstream toe of the main dam. A 16,000-ft. diversion tunnel and a 7,100-ft. pressure tunnel are included in the project, which is a combination water-supply and hydro-electric development.

Construction of 11-Mile Canyon dam, to provide a reserve that will permit more complete use of the Lake Cheesman supply of Denver, was begun in August, 1930, and is to be completed in July, 1932. Work was at the 50-ft. level when this picture was taken. The total height is to be 112 ft.

▶ *Additional Water for the Panama Canal*—Contract for the construction of the dams to form the Madden reservoir on the Chagres River in Panama was let in September. The main dam is of concrete 140 ft. high flanked by earth and gravel fills with concrete corewalls. Several small earth- and gravel-fill dams to close off side valleys also are included in the contract. The reservoir will have a capacity of 22,056,000,000 cu.ft., and an additional storage of 12,000,000,000 cu.ft. will be available for maximum flood conditions. A power house containing three units of 8,000-kw. capacity will be built in connection with the dam.

Hydro-electric power developments

▶ *Mokelumne River Project*—The first stage of the Mokelumne River power development program has been completed including the Salt Springs dam and power plant and the Tiger Creek power plant. Main storage for the project is provided by the record-breaking 328-ft. Salt Springs rock-fill dam. Utilizing the head from this reservoir the Salt Springs plant develops 11,000 kva. and discharges directly into the conduit to the Tiger Creek plant. This 21-mile conduit of concrete flume and tunnel includes a 175 acre-ft. regulating reservoir and terminates in a single penstock line leading to the plant. Operating under an effective head of 1,190 ft. two



The Abitibi River in Northern Ontario is being dammed for power by a concrete dam across the river canyon flanked by earth-fill dikes. The river is diverted through two large tunnels. A power house below the dam will contain five 66,000-hp. hydro-electric generators developing a head of 237 ft.

double impulse wheel units run the two 30,000-kva. generators. Work is now going forward on lower river development which includes reconstruction of the old Electra plant, its conduit system and installation of a small intermediate plant. Subsequently, a supplemental supply will be stored on the Bear River and diverted into the Mokelumne shed.

▶ *Ariel Dam*—Completion of the 313-ft. arch dam and installation of a 45,000-kw. generator conclude the present program of power development at the Ariel project on the Lewis River, 32 miles north of Portland, Ore. The development will ultimately be increased by three more units. The structure will store 23,000 acre-ft. and produce a 200-ft. head for the power house located at the downstream face. It is the beginning of a program for extensive development of the river.

▶ *New-Kanawha Power Projects*—The Hawks Nest hydroelectric power development on the New River in West Virginia is expected to be completed in the fall of 1932. It comprises a dam 60 ft. high, a pressure tunnel through rock 16,250 ft. long and a power station with four units of 30,000 kva. each, operating under a static head of 163 ft., together with an intermediate surge basin, a surge tank and penstocks. The construction of this plant was begun in March, 1930. To date the foundations of the dam have been completed and the abutments built to pool level or above; six of the fourteen spillway gate sections of the dam have been completed to spillway height and two others nearly completed. The concrete work of the intake is, for the main part, completed. About 95 per cent of the tunnel has been excavated and the invert of the concrete-lined portion of the tunnel has been started. The concrete substructure of the powerhouse has been substantially completed and the steel work of the superstructure has been completed.

The coordinated steam-electric power station at Alloy, W. Va., was completed, except for minor details, at the end of 1931. Construction of this station was begun in May, 1930. It contains two turbo-generator units of 30,000 kva. each, and will be connected with the Hawks Nest hydro project.

▶ *Safe Harbor, Pa.*—Work on the hydro-electric plant on the Susquehanna River at Safe Harbor, Pa., is practically complete. The initial installation of six 42,500-hp. units has been put into service. The ultimate installation will be 510,000 hp. The turbines operate under a gross head of 55 ft. developing the usable head between tailwater of the Holtwood plant and the pool level of the Conowingo plant.

▶ *Beauharnois Power and Navigation Project*—Construction of the Beauharnois power and navigation project includes a 15-mile canal, 3,380 ft. wide between dikes, by-passing the rapids of the Soulanges section of the St. Lawrence River, from Lake St. Francis, along the south side of the river, to a power house at Lake St. Louis. The canal effects a drop of approximately

Work on the Rock Island hydro-electric plant on the Columbia River in Washington is practically completed, including the installation of four 15,000-kw. generators. During the present low-water season the west channel section, consisting principally of spillway gates, will be completed. The entire project is scheduled for completion in August.

Beauharnois power house built to contain 500,000 hp. in generating units. The bulkhead of the power and navigation canal is at the left, and at the upper right is the St. Lawrence River as it enters Lake St. Louis.

81 ft. for power and navigation at the Lake St. Louis end. Construction work was started in August, 1929. The work is chiefly an earth-moving proposition on a large scale. Control works at the head of Coteau Rapids also are included in the project. Work on the canal and power house is being pushed rapidly. In view of the large quantity of earth and rock to be moved (30,000,000 cu.yd. for the initial 200,000-hp. development) unusually large excavating equipment is being used. Up to the end of the year 25,800,000 cu.yd. of earth and 1,215,500 cu.yd. of rock had been moved, and 407,800 cu.yd. of concrete had been placed. The installation of the power house machinery and generators for two 3-phase, 60-cycle, 8,000-hp. station auxiliary, two 3-phase, 60-cycle, 50,000-hp. and two 3-phase, 25-cycle, 50,000-hp. units is nearing completion.

▶ *Winnipeg River, Manitoba*—The initial stages of two plants on the Winnipeg River were completed during the year. At Seven Sisters Falls three units of 37,500 hp. each are in operation under a partial head of 41 ft. Ultimately three more units will be added. At Slave Falls two of an ultimate of eight units of 12,000 hp. are installed and in operation.

▶ *Masson Falls, Lievre River*—Construction of the dam for the 130,000 hp. plant at Masson Falls on the Lievre River in Quebec is well along toward completion and the diversion tunnel is more than half driven. The plant is expected to be in operation by the middle of 1933.

▶ *Rapid Blanc on the St. Maurice River*—The dam and the substructure of the power house for the hydroelectric plant at Rapid Blanc on the St. Maurice River in Quebec are practically completed. The initial installation will be four units of 40,000 hp. each with provision for two additional units. Operation is expected to begin in November 1932.

▶ *Chats Falls on the Ottawa*—Construction of a dam and a power plant in the rapid section of the Ottawa River at Chats Falls about 20 miles above Ottawa, Ont., is nearing completion. The dam, of gravity bulkhead, sluiceway sections, and low earth embankment is about three miles long. The power house is located in the dam astride the boundary between Ontario and Quebec with four units of 28,000 hp. capacity each on each side of the line. Provision is made for two additional units. Four units are in operation. The turbines operate under a head of 57 ft.

Sewage-treatment works

▶ *Sanitary District of Chicago*—In accordance with the Supreme Court decree of April 21, 1930, the Sanitary District of Chicago has accomplished on its sewage-treatment program in new work a total expenditure of about $10,026,000, of which $4,687,000 was expended in 1931. At the end of 1931 the population equivalent under treatment was 2,370,000—or, on a 100 per cent basis, 1,523,000. This is estimated to be 31.3 per cent of the total sewage within the district.

The North Side works have been operating on a full flow throughout 1931, handling a human population of 1,023,000. Plans are being drawn for additional preliminary settling tanks and equipment to improve operation.

At the West Side works two batteries of Imhoff tanks have been operated. A third battery was put under construction in February and is now 55 per cent completed. The sludge railroad is in operation. The flow from 729,000 population is now being treated. Work is under way on two sections of the West Side intercepting sewer. Bids received for section 5, however, were returned unopened because of the financial situation. Several contracts have been let for plant extensions at the Calumet works.

From the financial standpoint, the Sanitary District is in good shape on paper, but like many of the other municipalities in Cook County, has been unable to sell its bonds for construction during the last three months. It is hoped that in 1932 remedial legislation will be passed by the General Assembly, which will enable the construction program to be resumed on a more active basis.

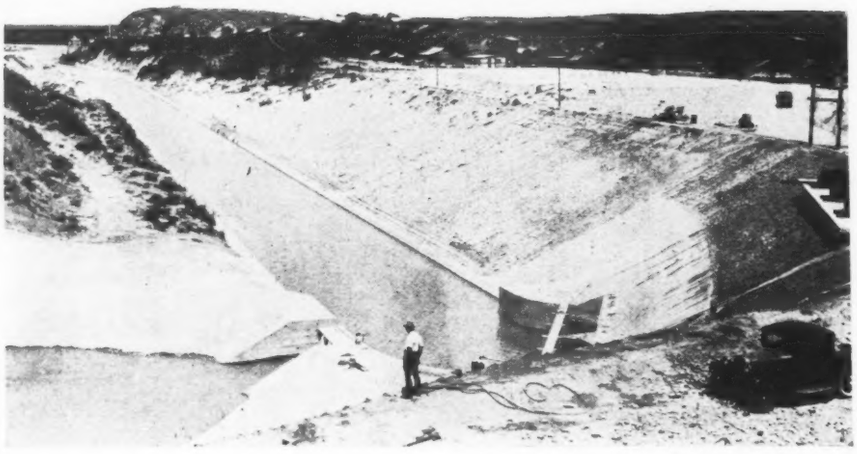
Power house at Salt Springs dam of the Mokelumne River power project in California. The 328-ft rock-fill dam is in the right background, and in the foreground is the conduit to the Tiger Creek plant.

▶ *Wards Island Sewage Plant* — Construction is well under way on the Wards Island sewage-treatment project in New York City. The present installation is to receive sewage now flowing into the Harlem and East rivers from the Borough of Manhattan from 73rd to 179th St. and from the Borough of the Bronx from St. Ann's Ave. to Jerome Ave. The treatment works is of the activated-sludge type and is to have a rated capacity of 180 m.g.d. and serve a population of 1,300,000. The cost of the project is estimated at about $29,000,000, of which $16,500,000 is for the plant and $12,500,000 for intercepting sewers.

The contract for the preliminary and final settling tanks, aeration tanks and operating galleries has been let and work was started on June 18, 1931. At the end of the year the major part of the excavation had been finished; concrete work and cast-iron piping in the pits and operating galleries of two batteries were well under way, as was also the concrete work in the substructure of the southerly return-sludge pumping station. The influent conduits, together with the four 72-in. venturi meters and the overflow conduit, are approaching completion.

The plans and specifications are completed for the pump and blower house and other sections of the works. It is contemplated that additional contracts will be awarded early this year. Plans for other parts are in preparation.

▶ *Dallas Storm-Sewer Program* — In September, 1931, Dallas, Tex., adopted



Headworks of the main canal of the Eagle Pass irrigation and power project, Maverick County, Tex., being built to irrigate 60,000 acres of land and develop 12,000 hp. of electric energy. The first unit, now practically complete, includes the power plant, 32 miles of main canal, siphons, and a lateral system covering 16,000 acres.

a general scheme of storm drainage for its principal watersheds which will fit in with the work of the Trinity River Levee District, the engineering work of which is now nearing completion. The new drainage plan involves the expenditure of $2,500,000 for the beginning of the main drainage system for Dallas Branch, Mill Creek and Peaks Branch watersheds. The first contracts were awarded in December, at a cost of $260,000, which was much below the estimate originally prepared. On the Turtle Creek diversion tunnel, an 8-ft. concrete-lined pressure tunnel through soft limestone, the average of several low bids was $20 per foot.

▶ *Cleveland Sewage Plant*—Initial contracts have been let for the construction of Cleveland's new Easterly sewage-treatment plant. The entire construction program involves a three-year period and a total cost of $12,000,000. If the existing low level of construction prices prevails, the cost of the entire works will be substantially reduced. Contracts have now been let for the breakwater in Lake Erie that will protect the site and for the aeration and sludge-settling tanks. Construction is proceeding on the preliminary excavation, installation of a cofferdam inclosing the site and piledriving. Also, considerable breakwater stone has been placed. The new plant will be built to serve 770,000 people contributing an average dry-weather flow of 123 m.g.d.

▶ *Milwaukee Sewage Plant Enlargement*—Milwaukee is engaged in enlarging its present sewage-treatment plant from a capacity of 85 to 200 m.g.d., at an estimated cost of $4,000,000. The extensions are to be built on land reclaimed from Lake Michigan adjacent to the existing plant. Now under construction is a steel-sheetpile bulkhead, 24½ ft. wide and 1,940 ft. long. Plans are being prepared for the tank and conduit extensions, and it is expected that contracts will be let in the middle of 1932. During the year there were added to the present plant three sludge driers, three return-sludge pumps and a 200-ft. extension to the sludge-storage building. The condenser equipment for disposing of the odors from the sludge driers is about completed. Contracts have been let for incinerator equipment for disposing of the screenings and grit.

▶ *Dearborn Sewage-Treatment Plant*—Construction was begun last August on the treatment plant for Dearborn, Mich. At the end of the year this new $450,000 plant was completed, with the exception of the installation of the pumping equipment. The new plant also is to treat the sludge produced by an existing Imhoff-tank plant after an 8-in. cast-iron sludge line connecting the two is completed. It is expected that both the sludge line and the alterations in the existing plant will be completed in March. The two plants together will then have a capacity of 60 m.g.d.

Reclamation and flood control

▶ *San Gabriel Flood Control*—Following a State Supreme Court decision making available the bond issue voted for the abandoned high concrete dam project for a revised flood control program on the San Gabriel River in southern California, the Los Angeles County Flood Control District has been actively carrying forward studies and preliminary work on the modified program. The present plan is characterized by the economic use of underground storage reservoirs with surface reservoirs for regulation and has been approved by the consulting board. The features include: (1) reduction of surface storage to 85,200 acre-ft. from the original 240,000 acre-ft. of storage planned at the Forks site, and (2) construction of two dams to provide this regulation in connection with spreading grounds. Site of the No. 2 dam on the West Fork has been approved by the board, and bids have been called for.

▶ *Owyhee Dam*—Ninety-one per cent completed at the close of 1931, the Owyhee dam being built by the Bureau of Reclamation in eastern Oregon is six months ahead of schedule. Concrete placing was discontinued during cold weather, as was done the previous year. This arched-gravity-type concrete dam is 530 ft. high above lowest foundation and will store 715,000 acre-ft. for new and supplemental irrigation along the Owyhee and Snake rivers. The 540,000 cu.yd. of concrete in the structure is being placed by an 8-cu.yd. bottom-dump bucket operating from an overhead cableway. Two 4-cu.yd. mixers handle 1,000 cu.yd. of concrete per shift. Only 1,280 ft. remained between headings on the 3½-mile tunnel from the reservoir. Progress on the No. 5 tunnel, a 4½-mile bore to serve the Succor Creek division, has been good, with about 1 mile left before holing through. Bids have been received on three short tunnels, which, with some canal lining, a flume section and two siphons, will practically complete the North Canal as far as the Owyhee River siphon.

▶ *Cle Elum Dam*—Construction of diversion works for the Cle Elum dam, Yakima River development, Washington, has been pushed since award of contract, Aug. 15. The camp has been completed, dam site and borrow pits cleared, and most of the area stripped of surface soil. Of the 2,700 acres in the reservoir site, 1,500 have been slashed and burned. The contractor has moved 110,000 cu.yd. of earth, practically completing the channel leading from the lake to the diversion tunnel and from the outlet of this tunnel to the river channel below the dam. The 19-ft. diversion tunnel under one abutment is being driven through water-bearing gravel using steel liner plates, and more than 1,000 ft. have been completed from two headings. Construction of the dam proper, an earth and gravel embankment, 130 ft. high, will begin in the summer of 1932 and is scheduled for completion by the close of the following year.

▶ *Middle Rio Grande Conservancy District*—Approximately 130 miles of river levees and drainage ditches completed by the end of 1931 represent more than 70 per cent of the total required for the first irrigation unit in the flood-control work of the Middle Rio Grande Conservancy District in central New Mexico. Other work of the flood-control program, which includes river changes and bank protection, is 80 per cent complete. In the drainage work intercepting drains have been completed behind all the river levees thus far built. In addition, 40 miles of a total of 180 miles

of interior drains has been built, together with all necessary structures. As a result, thousands of acres of waterlogged land are now properly drained. A reinforced-concrete diversion dam with control works, the first of four units in the irrigation system, will be completed by early spring and ready for the 1932 irrigation season. This dam will serve 40 miles of main canal. Of 24,000,000 cu.yd. of excavation required, more than 10,000,000 cu.yd. has been excavated. Plans for 1932 are affected by bond-market conditions, work having been stopped in September by failure of bond bidders to exercise their options. Funds obtained from tax levies and local sale of bonds are being used at present. The entire project includes 500 miles of canals and laterals and 400 miles of levees and drainage ditches. The estimated cost is $10,000,000.

► *Rodriguez Irrigation Dam, Mexico*—Work on the Rodriguez Dam on the Tijuana River, Mexico, about 27 miles southeast of San Diego, Calif, was resumed in December after nearly a year of inaction due to financial conditions. The dam is of the Ambursen type, 187 ft. high above streambed and 240 ft. above the lowest foundation, the highest of the type yet built. The work is about 35 per cent complete.

► *Bridgeport and Eagle Mountain Dams*—Of the two earth dams being built by Tarrant County Water Control and Improvement District No. 1 on the west fork of the Trinity River for water supply and flood protection to Fort Worth, one (the Bridgeport dam) is complete, and the other (at Eagle Mountain) is 60 per cent complete. The Bridgeport dam contains 2,360,000 cu.yd. of fill, while the lower dam at Eagle Mountain will require 390,000 cu.yd.

► *Lake Okeechobee Flood Control*—Work was started during the past year on the flood control program at Lake Okeechobee, Florida. The project provides for the construction of 63 miles of levee around the south side of the lake and 21 miles around the north side, at an estimated cost of over $8,000,000. The levees are to be 31 ft. above mean low water, and will be capable of being raised 3 ft. Rock riprap is to be placed on both slopes. In addition the work contemplates the enlargement of the St. Lucie canal and Caloosahatchee river to a depth of 6 ft. and a width of 80 ft., providing a discharge capacity of 2,500 sec.ft. for each. Hurricane locks will be provided to permit sudden lowering of the lake level in times of threatened storms. So far, location surveys and preliminary drillings have been completed. The government has completed a section of experimental levee on the south side and contract for additional levee has been awarded. Contracts for dredging the Caloosahatchee and St. Lucie canal have been awarded. The entire project is to be financed by payment of $9,027,000 by the goverment and of $2,000,000 by the state. To date the government has contributed $700,000 and the state $200,000.

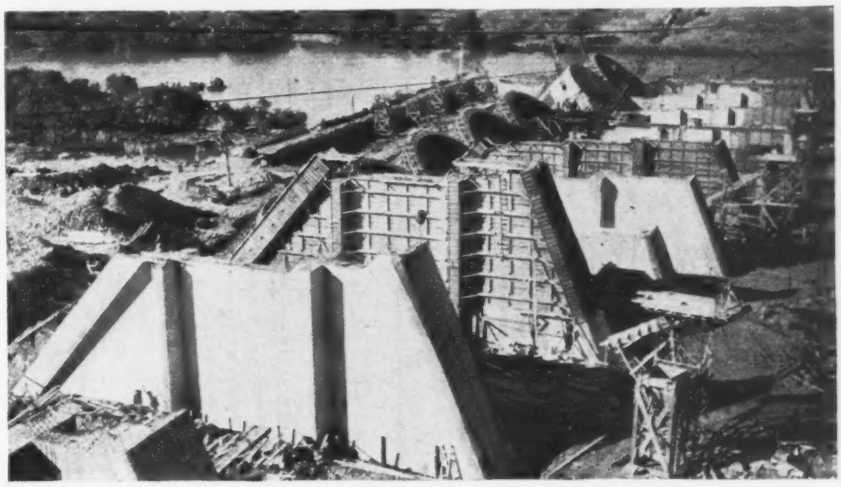
Bridge construction

► *Golden Gate Bridge*—Legal obstacles have been blocking progress on the Golden Gate bridge project, San Francisco, since letting the construction contract for this record-breaking 4,200-ft. suspension span. Bids for construction were well under the estimate, and contracts were awarded in July, 1931, but made conditional for six months on the settling of legal questions. Bids on the first $6,000,000 block of bonds of the $35,000,000 issue voted by a three-to-one majority in November, 1930, were satisfactory, but bidders requested a state supreme court ruling on the vadidity of the district's right to taxation for meeting possible revenue deficiencies. The court ruling was favorable, but the legality of the district was subsequently attacked in the federal court by taxpayer interests openly backed by the ferry company now operating across the Golden Gate. This issue is still before the federal court and may be carried to the highest court. Meantime, the optional time on the bond bids has been extended six months.

► *San Francisco-Oakland Bridge*—Preliminary design studies and foundation explorations are well advanced on the San Francisco-Oakland bridge project, under direction of the California Toll Bridge Authority. Present plans call for a suspension-type structure with two decks providing for six lines of vehicular traffic on the upper and two rapid-transit tracks and trucking traffic on the lower. Final designs for the 7,500-ft. section from San Francisco to Yerba Buena (Goat) Island will depend on the results of foundation borings and selection of spans. Three span arrangements are under consideration: (1) Two 2,300-ft. spans with 1,150-ft. side spans having a common gravity anchorage in mid channel; (2) a single 3,800-ft. span with 1,850-ft. side spans; and (3) a multiple design of three 2,300-ft. spans with top tie cable. Final decision on the arrangement of spans came before the consulting board in January, and final design studies will follow. Present plans call for piercing the top of Yerba Buena Island by double-deck tunnel and continuing to the Oakland side of the bay by shorter spans and viaduct. Studies are under way for the necessary highway approaches and rearrangement of rapid transit and main-line transportation on the east side. Plans are also being made for facilities to handle the heavy commuter traffic. Explorations in the bay have been unusually extensive in an area practically unknown as to foundation conditions. Results indicate satisfactory rock conditions for the main suspension span at feasible depths. The project will be a publicly-owned toll structure to be financed by revenue bonds. Present plans estimate that bids may be called by the close of the year and the project completed in 1937.

► *Boonville Lift Bridge*—The Missouri River bridge of the Missouri-Kansas-Texas Railroad at Boonville, Mo., said to include the largest railroad lift span, will be completed early in 1932. Four piers of the substructure, completed in November, 1930, were constructed by the pneumatic process, the deepest reaching 59 ft. below low water. There are three 300-ft. and one 247-ft. simple Warren spans, one 408-ft. Warren-type vertical-lift span and one 60-ft. through plate-girder span, designed for Cooper's

Hamilton dam, first of a series to be built on the Colorado River in Burnet and Llano counties, Tex., for power purposes. It is a multiple arch of 28 spans of 70 ft. and 97 of 35 ft. flanked by 2,997 ft. of gravity section and 900 ft. of earth fill, a total of 9,252 ft. The maximum height is 135 ft. Two 10,000-kw. hydroelectric units are to be installed, and provision is made for a third unit. Work started in April, 1931.

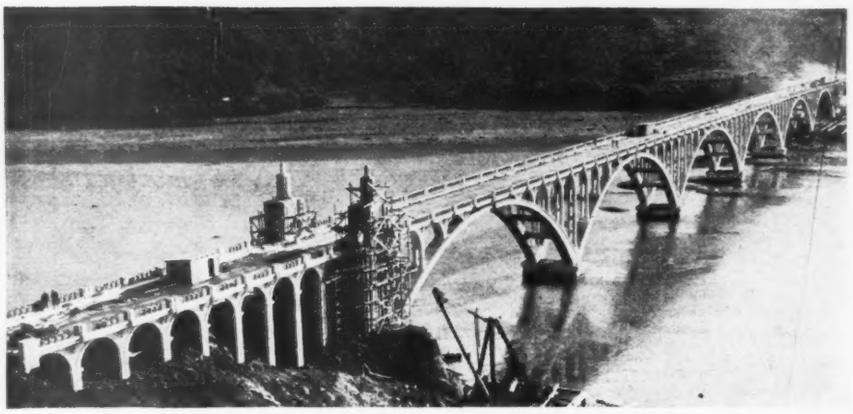


E-70 loading. Silicon steel was used, except for the floor system. For the lift span the rise is 30 ft., providing 55-ft. clearance above high water. The cost of the entire project, including a slight change in track alignment at each end of the bridge, is about $1,000,000.

▶ *New Orleans Bridge*—Contracts for both the substructure and superstructure of the combined railroad and highway bridge to be built across the Mississippi 7 miles above New Orleans were awarded late last year. The bridge will be 23,000 ft. long, including the railroad approaches. The main spans will be cantilever trusses carried on concrete piers extending 160 ft. below low-water level.

▶ *Arkansas River Bridge*—The reinforced-concrete arch bridge built by the Arkansas state highway commission across the Arkansas River at Ozark, Ark., and consisting of six two-rib open-spandrel arch spans, five of 237 ft. and one of 185 ft., was opened in April, 1931. In the longer spans the rise is 48 ft. 2½ in., and the springing line is about at high-water level. Including two concrete-girder spans and abutments, the total length of the structure is 1,537 ft. The clear roadway width is 24 ft.

▶ *Henderson Bridge*—Substructure work is well advanced for the new Ohio River bridge of the Louisville & Nashville Railroad at Henderson, Ky., to replace the existing single-track crossing built in 1885. In the new bridge there will be four 500-ft. spans, a channel span of 675 ft. and a 240-ft. north approach span. Across the low bottom lands on the Indiana side the approach will consist of 56 concrete piers on concrete-pile foundations, supporting a series of girder spans ranging from 30 ft. to 125½ ft. in length. The Kentucky approach will be of earth fill, with girder spans over the streets. All the river and approach piers will be for double track, as will the main spans, but the approaches will be built for single track at first.



Rogue River bridge, Oregon, seven 230-ft. arches, the first to be built in this country by utilizing the Freyssinet method of decentering and stress adjustment. The structure replaces a state-owned ferry.

▶ *Chicago Outer-Drive Bridge* — The Outer-Drive bridge now under construction at the mouth of the Chicago River is the principal unit of a $10,000,000 improvement linking the Lincoln Park and South Park boulevard systems and designed to relieve traffic congestion on Michigan Ave. It is to be a two-leaf, trunnion bascule bridge of the fixed counterweight or Chicago type, with a navigation clearance of 24 ft. in the closed position and a clear span of 220 ft. between counterweight pits. Initially the bridge will be constructed with a single deck, but the design provides for a lower-level roadway when traffic requires it. The entire bridge is to be ready for traffic in December, 1932. The estimated cost of construction is $1,800,000.

Tyngsboro bridge over the Merrimack River near Lowell, Mass., a 547-ft. arch, the largest highway bridge in the state.

▶ *Pittsburgh Bridges* — The McKees Rocks steel-spandrel-braced arch of 750-ft. span over the Ohio River was completed.

The West End-North Side steel tied-arch of 780-ft. span, also over the Ohio River, was completed except for sidewalks, but work is still under way on the North Side approach, which entails major changes in the roadways piercing the Pennsylvania Railroad embankment that parallels the river at this point.

Work on the 725-ft. South Tenth St. suspension bridge over the Monongahela River includes the anchorages, piers and towers. Placing of the cables has begun. The bridge is expected to be completed this year.

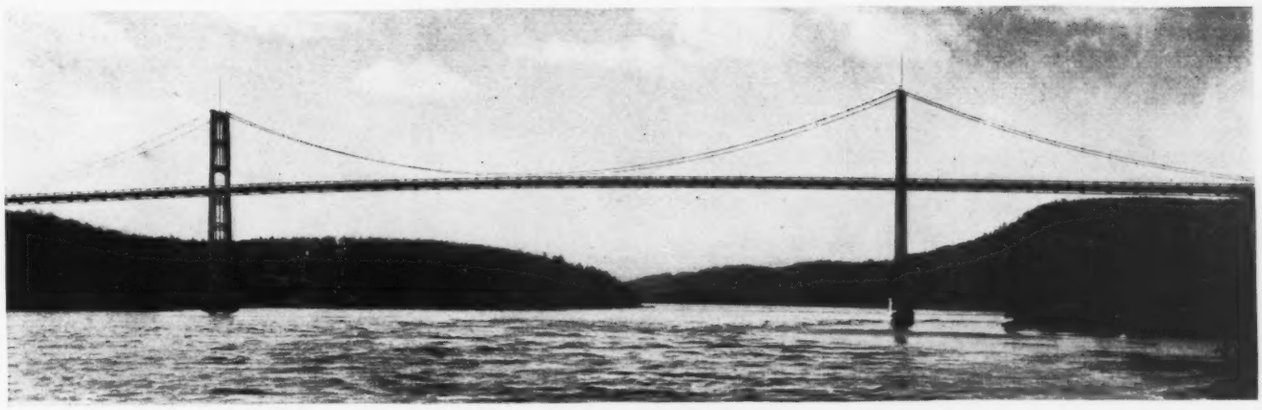
The George Westinghouse Bridge over Turtle Creek Valley, whose center span of 460 ft. will be the longest concrete arch in this country, was advanced to the point where only the roadway paving, handrails and pylons remain to be placed.

The Ohio River Boulevard bridges were completed, and this important artery placed in service.

▶ *Bridges at New York*—The George Washington suspension bridge, with its record span of 3,500 ft. over the Hudson River at New York, was opened to traffic on Oct. 25, 1931, with six of its ultimate nine lanes paved. Finishing work on the elaborate approaches is still under way, with promise that all of the facilities planned for the initial development will be completed this year.

The Bayonne bridge, a steel arch with an unsurpassed span of 1,652 ft., was completed during the year and opened to traffic on Nov. 15.

The Triborough bridge to be built over the East and Harlem rivers reached the end of the year with a somewhat uncertain future, because New



Waldo-Hancock bridge, an 800-ft. suspension structure over the Penobscot River and the first long-span bridge in Maine. It has twisted-wire strand cables.

York City's economy measures threatened to hold up letting of the first contracts for the steel towers of the 1,380-ft. suspension span over the East River near the Hell Gate arch bridge. At present the tower foundations, the anchorage blocks and a number of viaduct piers on Wards Island are completed.

The Shelter Island bridges, two suspension spans of 700 and 1,100 ft., respectively, at the northeast tip of Long Island, reached the contract stage only to be held up by an injunction.

Work on the New Jersey highway department's 15,000-ft. high-level viaduct west of the Holland Tunnel was actively prosecuted. The two cantilever crossings of the Hackensack and Passaic rivers, each of 550-ft. main span, were completed, and three of the four long sections of steel-truss viaduct were under way. Work will begin on the fourth section in April of this year.

Railways and rail terminals

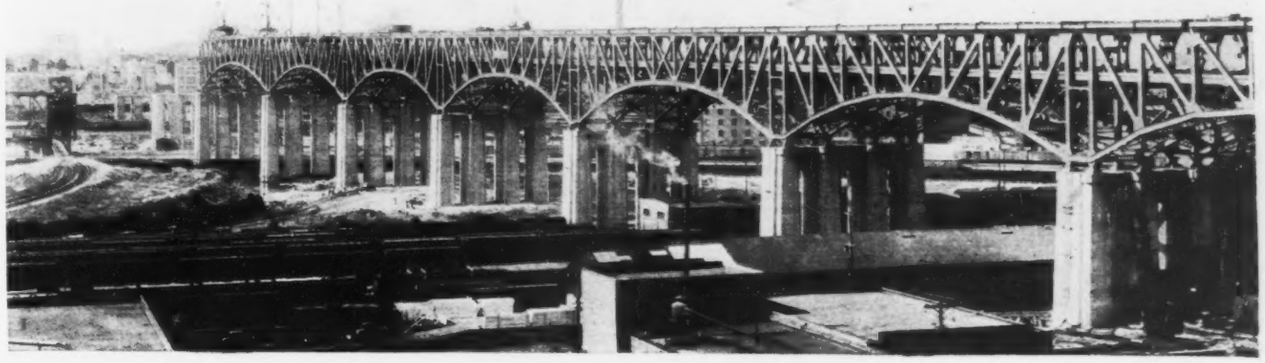
► *Great Northern-Western Pacific Connection*—With a typical last-spike- driving ceremony the rails of the Western Pacific and the Great Northern systems were officially connected in northern California in November, 1931, following a year's construction work. The 200-mile link was a joint project, the Great Northern building south from Klamath Falls, Ore., for 88 miles, and the Western Pacific building north from Keddie, Calif., for 112 miles. The former section was comparatively light construction, but the Western Pacific portion involved twelve tunnels, fourteen steel viaducts and bridges and heavy grading. Freight is being handled over the new line, but passenger-service entry of the Great Northern into San Francisco is not planned until spring.

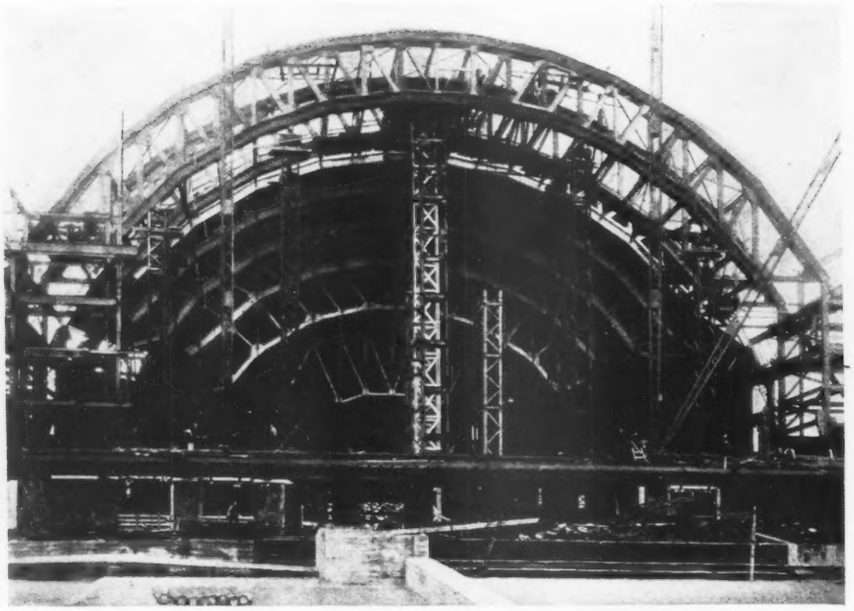
► *Cincinnati Union Station*—For this extensive terminal project, started in August, 1929, the Cincinnati Union Terminal Co. has expended for land and construction work about $21,000,000 up until 1930 and spent $8,300,000 in 1931. For 1932 its anticipated expenditure is $14,000,000, leaving about $6,000,000 in 1933 to complete the $41,000,000 project, which will combine in one terminal all of the passenger facilities of the seven railroads entering Cincinnati. There will be a union passenger-equipment terminal as well as a union passenger station, with 130 acres for the terminal proper and 157 acres for the facilities of other railroads that had to be moved or replaced. Progress has exceeded expectations, so that the date of completion has been advanced from September, 1933, to the spring of 1933. The work done in 1931 included the completion of the 3,500-ft. $3,000,000 double-deck Western Hills viaduct across the terminal site. For 1932 the work planned includes completion of the grading, 45 miles of tracklaying and completion of the $4,200,000 passenger station.

Lorain Central viaduct, a new high-level traffic artery extending 4,500 ft. across the Cuyahoga River Valley in Cleveland.

► *West Side Track Elevation, New York*—Work on the removal of the tracks of the New York Central from the surface of the streets on the west side of Manhattan Island made good progress during the year. Most of the right-of-way below the 30th St. yard was cleared, and a considerable part of the foundations for the elevated structure and for the new terminal north of Canal St. was put down. Reconstruction of the 60th St. yard to accommodate the footings of the West Side elevated highway and some reconstruction north of that point also was carried out. The substitution of oil-electric locomotives for steam locomotives was completed during the year. The total cost of the work was estimated at $138,700,000 at the time it was begun in 1930.

► *Philadelphia Terminal, Pennsylvania Railroad*—Entire reconstruction of the Philadelphia terminals of the Pennsylvania Railroad at a cost of more than $50,000,000 (including $16,000,000 paid by the city for street improvements), is about 80 per cent complete. The work was begun in 1925. Late in 1930 the electrified underground suburban station adjoining the old Broad St.





Dome trusses of 200-ft. clear span are being installed in the union terminal at Cincinnati.

station was put into service. Work now is centered on the construction of the new 30th St. station west of the Schuylkill, which will replace the old Broad St. station, and upon the yard and terminal facilities west of the river. The work will be completed in 1933.

▶ *Pennsylvania Electrification*—Electrification of the main line of the Pennsylvania Railroad for passenger service between New York and Philadelphia is expected to be completed sometime next summer. This will give a total of 585 track miles. Electrification of the line from Wilmington, Del., to Trenton, N. J., is completed. Work on the foundations for the overhead system south from Wilmington to Washington is one-third complete. Changing the New York zone over from direct to alternating current is part of the undertaking.

▶ *Reading Electrification* — Electrification of the Philadelphia suburban lines of the Reading Railroad from Philadelphia to West Trenton, N. J., was completed during the year. Electrification of the Chestnut Hill line is under way.

▶ *Newark and Baltimore Terminals*—Extensive reconstruction of its passenger terminals in Newark, N. J., and in Baltimore, Md., has been begun by the Pennsylvania. The Baltimore work includes new tunnels under the city, and at Newark additional tracks and a new station, also new lift bridges over the Passaic River. Both projects are closely related to the New York-Washington electrification work.

▶ *Inland Freight Terminal, New York*—Construction of the first of a number of inland union freight terminals on Manhattan Island was begun by the Port of New York Authority early in 1931. The building will be sixteen stories high and have two basements (a total of 38,000,000 cu.ft.) and will occupy the entire block between Eighth and Ninth Aves. from 15th to 16th Sts., New York. The total cost will be about $10,000,000. No rails will enter the building, all service to and from rail terminals being by truck. Truck elevators will serve the upper floors of the building.

▶ *Canadian National Terminals, Montreal*—Reconstruction of the Canadian National Railway passenger and freight terminals in Montreal, began in October, 1930, was largely stopped in October, 1931, due to financial conditions. Work on separate pieces of construction, such as some of the viaducts over station and terminal tracks, then nearing completion, was not stopped, but no new work is to be initiated at present. The work was estimated to cost $50,000,000 and to take five years.

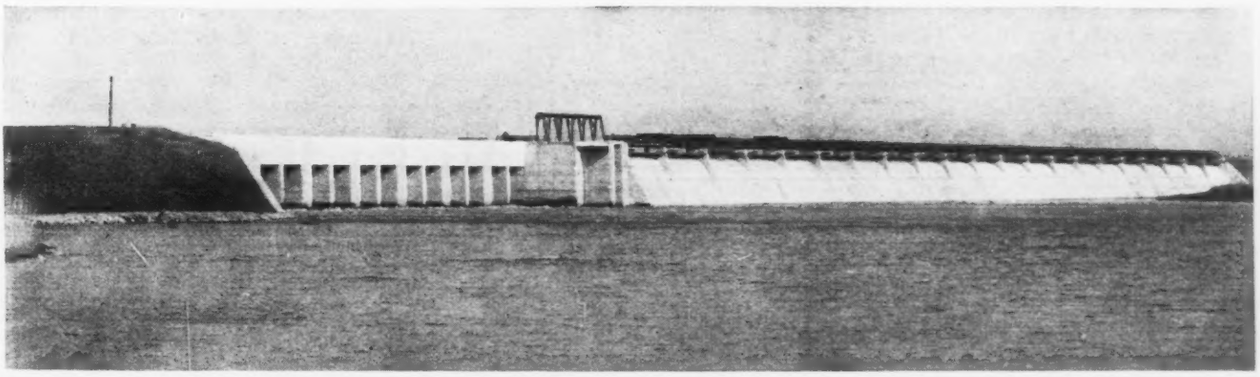
Inland waterways

▶ *Lock and Dam 15, Mississippi River*—Dam 15, with two parallel locks, now under construction between Davenport, Iowa, and Rock Island, Ill., is one of twenty-five such developments to be constructed on the Upper Mississippi between St. Paul, Minn., and St. Louis, Mo., to provide a 9-ft. navigation channel. The locks, which have been under construction since April, are now 65 per cent completed. They consist of a main lock, 600 ft. by 110 ft., and an auxiliary lock, 360 ft. by 110 ft. They have a maximum lift of 18.5 ft. The dam is to be of the roller-gate type. It will be provided with a service bridge and a 30-ton crane for handling drift.

To protect the Iowa shore from overflow by the pool above the dam, a reinforced-concrete river wall, 9,600 ft. long, is to be constructed. The wall will be built integrally with an intercepting sewer to carry Davenport's sewage below the dam. The total length of the sewer is to be 22,360 ft. Bids were received in December for the construction of the dam, river wall and intercepting sewer. The low bid was $3,322,000. The total cost of the dam, locks and appurtenant work, including flowage rights, levees and dredging will be about $5,000,000.

▶ *Illinois Waterway*—This 60-mile link in the connection between Lake Michigan and the Mississippi extends from the lower end of the Chicago Drainage Canal at Lockport, to the Illinois River at Starved Rock, about a mile above Utica, Ill. When the state of Illinois found that it would be unable to complete this project with its $20,000,000 bond issue, Congress authorized, on July 3, 1930, the completion of the waterway by the United States at a cost not to exceed $7,500,000. On

Grade-separation work in the business section of Birmingham, Ala., is being accomplished by track elevation.



Head gates, sluice gates with trolley, and the main dam with its tainter gate bridge at Brandon Road on the Illinois waterway.

Dec. 20, 1930, the first allotment of $1,200,000 was made available. This project includes five locks, four dams, heavy concrete retaining walls along each side of the river through Joliet, a 2½-mile canal at Marseilles, and considerable earth and rock excavation in the four pools. The locks at Lockport, Brandon Road, Marseilles and Starved Rock are completed, except for minor details. At Dresden Island, the lock walls and lock gates are 70 per cent completed and the dam about 30 per cent. Plans and specifications for the Marseilles dam have been completed. Bids for this work and for rock and earth dredging in the four pools will be invited at an early date. The channel is to have a minimum width of 200 ft. and a minimum depth of 10 ft. Lock chambers are 110 x 600 ft. Recent orders from the Chief of Engineers, U. S. Army, contemplate the completion of the work authorized by Congress by Oct. 15, 1932. Under the act of Congress, all bridges must be rebuilt by the state of Illinois, which has sufficient funds remaining from its bond issue. Of the eleven highway bridges required (estimated to cost $2,500,000), several are under contract, and it is expected that contracts for the others will be placed early in 1932. Reconstruction of other railroad bridges probably will be commenced this year. Until these railroad bridges are rebuilt the controlling vertical clearance will be 20 ft. above normal pool level. The reconstruction of the Rock Island R.R. lift bridge at Joliet has been completed.

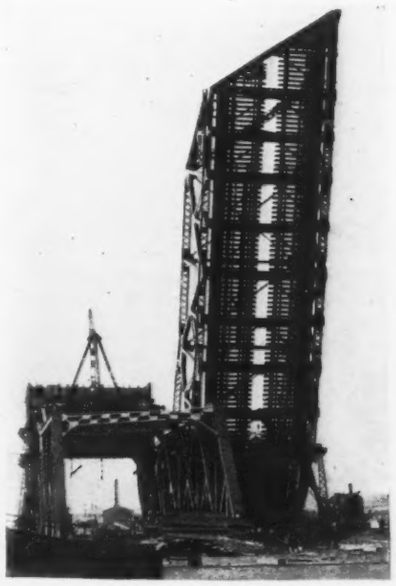
Rapid transit

▶ *Chicago Subways*—A three-fold legal problem still delays any material progress on the Chicago subway project, although the engineering plans are complete for the State St. section and for the widening of the State St. bridge over the Chicago River. The objections filed in court to the special assessments for the State St. widening have not yet been disposed of, but a final ruling is expected early in the year. The courts have also received objections from 301 law firms to the State St. subway section assessments. No hearings have yet been held, but the city has been able to dispose of the objections of 174 of the attorneys. The traction ordinance itself, providing for the consolidation of the present transportation facilities and making the whole subway plan possible, is still under attack in court, charged with being illegal and unconstitutional. The actual case involved is a taxpayers' suit asking that the city be enjoined from expending any funds in connection with its obligations under the ordinance.

▶ *Detroit's Master Transportation Plan*—Development of the master plan for thoroughfares and superhighways for the Detroit region was continued during 1931 by the Detroit Rapid Transit Commission. The plan embraces the area within 15 miles of the city hall, comprising 400 sq.mi., which it is expected will be occupied by the city in 1950. About 40 per cent of the total right-of-way required has been secured, that outside the city limits principally by dedication and release and at relatively little cost. Within the city right-of-way has been acquired more slowly and at greater cost. The city has spent $12,000,000 for this purpose since 1925.

No positive action has been taken with reference to construction of rapid-transit trunk lines. A study of the revision of the present surface-line and motor-coach system is under way, with the purpose of fitting further improvements into the final transportation plan. The city is legally in position to undertake construction of subways as any time, being authorized to issue bonds for rapid-transit purposes to the extent of 2 per cent of assessed valuation in excess of any other limitations on the bonding limit. At the present time this credit amounts to $67,000,000. Under present financial conditions it is not expected that any move will be made during 1932 to initiate construction.

Two of four double-track bascule bridges installed in the reconstructed Boston & Maine terminal at Boston.



▶ *Boston Subways*—The difficult job of extending the Governor Square subway line in Boston for 4,500 ft. is 75 per cent completed. Work is being done by the transit department of the city of Boston on a day-labor basis. The project, costing over $5,000,000, also provides for an underground loop to turn part of the trains back to the city at this point.

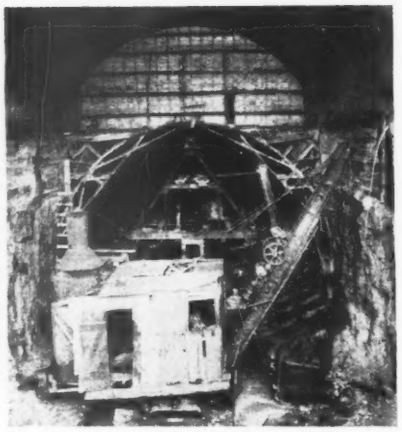
▶ *Philadelphia Subways*—At the end of the year subway construction in Philadelphia consisted of an extension to the Broad St. subway in South Philadelphia, the building of a branch to the Broad St. line in Ridge Ave., Eighth St. and Locust St.; straightening of the tracks of the Philadelphia Rapid Transit Co. under City Hall; subway construction in Market St. under and adjacent to the Schuylkill River, to take the place of the existing elevated line at that point and the construction of a new Market St. bridge over the Schuylkill. The Ridge Ave. branch line is well along. Work under City Hall is progressing slowly because of difficulty with the building foundations. The Schuylkill River work involves the building of a new concrete-arch bridge with the subway running through its piers and abutments. This work is part of the improvement program participated in by

the city and the Baltimore & Ohio and the Pennsylvania railroads. All the subway work is being carried out by the Philadelphia department of city transit. During the past year 34 contracts were under way, involving a contract expenditure of $12,350,000. Uncompleted work on 24 contracts and work on twelve new contracts, which is held up temporarily for financial reasons, will require a further expenditure of $10,000,000 during the coming year.

► *New York Subways*—Construction of the entire 55 route miles of New York's independent subway system, begun in 1925, is now complete or under contract except for the four-track section in Sixth Ave. Start of work on this section has been postponed pending completion of the new water tunnel now under construction, because of the possibility that blasting might damage the section of the Catskill aqueduct under Sixth Ave., the city's only connection with that source of supply. The third and last of the East River crossings of the new system, the twin-tube Rutgers-Jay St. tunnels, was holed through recently. The Harlem River tunnels are about complete. Expenditures for construction during 1931 totaled more than $92,000,000, of which $89,482,474 was for the independent system and the rest for completion of various projects under the so-called dual contracts of 1913. Contracts awarded during 1931 total $29,190,503, including $23,824,556 for equipment. Completed track and that under contract totals 142 miles, out of approximately 200 miles required for the new system.

Other important projects

► *Midtown Hudson Tunnel, New York*—Surveys, design studies and the preparation of contracts and specifications are being prepared for a second vehicle tunnel under the Hudson River at New York, which the Port of New York Authority was authorized to build in March. Land also has been acquired, but actual start of construction has been postponed until bonds to finance construction can be sold more advantageously. Plans for a cross-town tunnel, to connect with the Hudson River tunnel, and for a continuing tunnel under the East River to Long Island City and Brooklyn were submitted to the city by the board of transportation in June but have not been acted upon.



The River Des Peres drainage work at St. Louis is scheduled for completion this year. The work here shown is at the point where the channel is carried under the Kingsbury Ave. bridge. Remaining contracts consist of completing the upper end of the 32-ft. reinforced-concrete sewer and the completion of channel and park work.

► *Boston-East Boston Tunnel*—The single-tube vehicle tunnel being driven for the Boston transit department between Boston and East Boston under Boston harbor is about 30 per cent complete. The tunnel will be 6,150 ft. long, 5,400 ft. between portals. It will carry two roadways 10 ft. 9 in. wide. Driving is being done from one end only, using an unusual installation of belt conveyors for handling muck. Pressed-steel liner plates are being installed inside a 31-ft.-diameter shield. The tunnel will be lined with concrete.

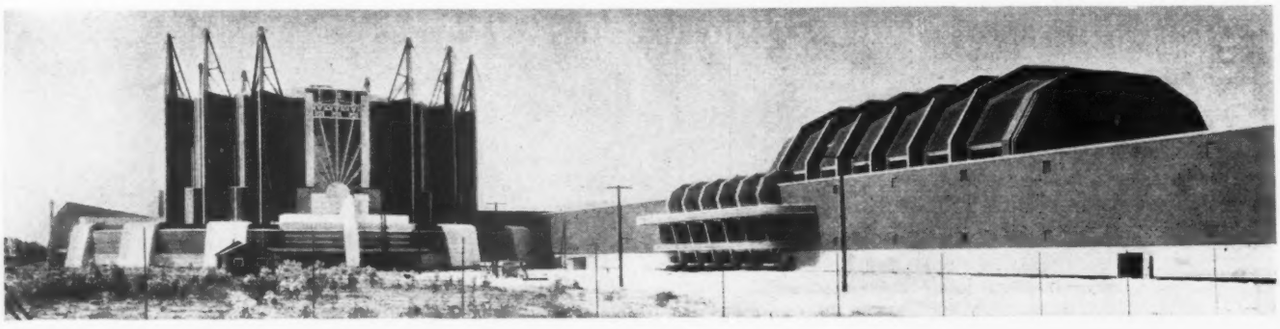
► *Chicago World's Fair*—Important construction progress for the 1933 international exhibition was made during 1931. At the beginning of the year (1932) there had been built the administration building, the replica of old Fort Dearborn, and the Travel and Transport building, with its 200-ft. circular steel dome suspended from cables attached to steel towers. Four steel-frame buildings begun during the year include the Hall of Science and the electrical group. About 3 miles of paving and highway widening was completed between 12th and 39th Sts. Construction of a 12-acre extension of Northerly Island also was undertaken to provide for exhibition buildings. This extension will cost $500,000 to $600,000.

Main buildings planned for 1932 include three in the general exhibits group ($150,000 each), the agricultural group on the island and several pavilions for state and foreign nations. Other projected buildings include one by the General Motors Corp. (about $1,000,000) and the modern housing group, comprising eight dwelling houses and a three-story apartment.

Travel and Transport Buildings, first of a notable group of structures of modernistic design for the World's Fair to be held in Chicago in 1933.

► *West Side Elevated Highway, New York*—Contract for the superstructure of the third of four sections of the elevated highway along the west side of Manhattan Island from Canal St. to a connection with Riverside Drive below 72nd St., a distance of about 4 miles, was let in December, 1931. Final decision as to the location of the remaining short section not under contract depends on proposed waterfront changes. The section from Canal St. to 23rd St. has been in use since November, 1930. The present structure has a six-lane roadway on one deck, with ramps at long intervals. Provision is made in the columns for a second deck when required.

► *Metropolitan Square Buildings*—Work on this huge group-planning project in New York was begun in May, with demolition of the buildings on the three-block site. Over 75 per cent of this demolition work is now completed. About 40 per cent of the excavation and considerable foundation work is finished. Steelwork for the 31-story office building on the northwest corner of the plot is erected to about the 20-story level. Steel designs are completed for the theater (the largest in the world) immediately east of this building, and its erection will commence soon. Steel designs for the 68-story office structure (larger in floor area than the Empire State building) will be ready in April. The steel contract for the entire project, about 125,000 tons, was let early in 1931.



NEWS OF THE WEEK

End of New York Subway Program Throws Engineers Out

Because of the rapidly approaching end of heavy construction work on the New York independent subway system, 210 engineers were let out from the board of transportation on Jan. 16 and another hundred are scheduled to go Feb. 15. For the past four months temporary appointees have been gradually dispersed with and resignations have not been filled. Quite a few engineers have been transferred from subways to other municipal departments. Start of the Sixth Ave. line, the only portion of the independent system not under contract, was held up last year because of danger to the Catskill aqueduct which underlies the proposed subway. It has not been decided whether this work will proceed at present or not. Meanwhile, station finish, track and signal work to finish the subway lines now under construction will continue. Probably no new subway work will be undertaken for the time being. The start of another system, with the Second Ave. line as its backbone, had been contemplated for 1932.

Reorganization Recommended of Ohio Highways Department

The committee named by the Ohio Senate last winter to investigate the state department of highways has filed its report. The principal recommendation is the establishment of a commission of six with a salary of $2,000 each to direct and control the administration of the department. The commission would appoint the director of highways, fix his salary, approve or revise the annual budget of the department, pass on all plans and projects submitted by the director, determine programs of improvements, let all contracts, approve all changes in the highway system, determine allocation of state highway improvement funds and establish general policies.

The recommendations will come before the Ohio legislature at its next session.

Washington's Engineering Bureau Is Reorganized

Complete reorganization of the engineering bureau of the District of Columbia has been approved by the district commissioners. Major D. A. Davison, who has been acting engineer commissioner since Major John C. Gotwals became ill last June, becomes executive officer, directing the activities of the department. Should Major Gotwals be retired for disability, Major Davison is thought to be slated to succeed him.

Harold W. Baker, commissioner of the department of public works, Rochester, N. Y., has been appointed director of the department of construction. Capt. Hugh P. Oram, who has held the rank of assistant engineer commissioner, relinquishes both this post and his army rank to become director of the department of inspection and executive officer of the district zoning commission. Capt. H. C. Whitehurst moves from the office of chief engineer of the highway department to be director of the department of highways, and H. B. Gordon is promoted from the rank of sanitary engineer to that of director of the department of sanitary engineering.

An engineering project board is also established with the three assistant engineer commissioners and the four directors. The executive officer will be chairman. This board will provide the engineer commissioner with information and advice as to the administration of the engineer department.

Water Rate Increase Refused for Unemployment Relief

The board of water and power commissioners of Los Angeles, Calif., has rejected unanimously the recommendations of Mayor Porter's special unemployment relief committee that Los Angeles water rates be increased sufficiently to raise $1,000,000 for relief. The commissioners were likewise unanimous in opposing a suggestion that the municipal power department appropriate $1,000,000 from its surplus funds for the same purpose. Concerning the proposed increase in water rates, a member of the commission said such a step would work hardship on many families to which a water bill is an important item in the budget.

Bids Called for Construction of Pine Canyon Dam

Bids have been called to be opened March 1 on the construction of the Pine Canyon dam at Pasadena, Calif. Specifications call for a concrete gravity dam 245 ft. high above streambed and 325 ft. above the lowest foundation. It will require 595,000 cu.yd. of excavation and 480,000 cu.yd. of concrete. The dam will store about 40,000 acre-ft. to provide additional municipal water supply for Pasadena.

Bidders are required to agree to give preference to workers who have resided in Pasadena at least three months and 75 per cent of workers must be such residents.

The total estimated cost of the project is $9,400,000. Design and construction is in charge of S. B. Morris, chief engineer and general manager of the Pasadena water department.

Economy Forces Dismissal of Engineers in Canton, Ohio

As an economy measure, imperative under a program of paring $500,000 from the city's operating expenses, a reduction has been ordered in the engineering forces of Canton, Ohio. W. E. Sarver, city consulting engineer and for many years head of the city engineering department, has been dismissed, and others suspended are L. W. Lutz, construction engineer, and Walter Sheetz, assistant engineer.

Cook County, Illinois, Takes First Step in Remodeling Assessment System

THE first step in reorganizing Chicago's assessment and taxation machinery was taken on Jan. 21 when the Illinois legislature passed the bill setting up a new method of selecting assessors. The action was forced by the critical financial condition of Cook County and its local governments caused by their inability to borrow short-time money for current expenses in anticipation of tax collections.

According to the new plan, the board of review will consist of two men, one appointed by the governor and the other by the president of the county board. These two will select the assessor, who, although he will not legally be a member of the board of review, will be so in effect, as the law requires that his assessments are to be final unless both reviewers decide against him.

The new system of assessment supersedes the plan whereby there was an elected three-member board of review and a five-member board of assessors, also elected. Under the old system the board of assessors divided the responsibility of the validity of assessment.

Because of the gross inequalities in assessment under the old system, the state legislature in 1928 ordered a reassessment of all Cook County real estate. The time necessary to put that order into effect caused a delay of two years in sending out tax bills, and it was necessary for the county and local governments to borrow money from the banks on tax-anticipation warrants to pay their current expenses. A recent decision by a county judge (see *ENR*, Jan. 7, 1932, p. 32) invalidates that assessment on the ground that personal property was not included to the degree required by the state constitution. The decision is now being appealed to the supreme court and if sustained new assessments must be made for all the years from 1928 to the present time. At the beginning of this year 20 per cent of the 1928 taxes and 30 per cent of the 1929 taxes were unpaid, tax bills had not been sent out for 1930, and the assessment for 1931 had not been made.

The new act of the legislature has yet to be signed by the governor, who has said that he will sign it as soon as he is assured that the men chosen for the new positions intend to see that personal property bears its proper share of taxation.

Further action of the legislature will be required to reestablish the credit of the county and local governments, so that they can raise money to continue operations and pay salaries.

Illinois Engineering Society Approves Model License Law

Seven section meetings held during the 47th annual convention of the Illinois Society of Engineers at Peoria, Ill., Jan. 27-29, were devoted to drainage; land surveying; water supply; sewerage; structures; electrical, mechanical and mining engineering; and highways. At the business meeting H. J. Fixmer, of Chicago, was elected president and M. L. Greely, of Chicago, vice-president. The 1933 meeting of the society will be held in Chicago. Most of the business meeting was devoted to a discussion of registration laws for the state, the society approving the model law prepared by the national engineering socities. The Illinois society instructed its legisiative committee to devote its efforts to having the law enacted by the Illinois legislature.

The first presentation of the society's annual award of a silver medal for the best paper during the year was made to W. W. Matthews for his paper, "The Galesburg Sanitary District." Certificates of honorable mention were presented to W. D. Jones for his paper, "When and How Boundary Lines," and to Paul E. Langdon, for "Rates of Water Consumption in Suburban Communities."

M. L. Greeley, in a paper entitled "Registration of Land Surveyors," recounted the history, dating from 1874, of the efforts to obtain a licensing law for Illinois land surveyors. After many years the legislature finally enacted such a law in 1919, but in 1928 this was declared unconstitutional by the state supreme court. During the past year a new licensing law for surveyors was passed by both houses of the legislature, but was vetoed by the governor within fifteen minutes of the time when it would have become a law automatically.

The development of water-purification processes in recent years was traced by Charles Spaulding. H. E. Babbitt presented an illustrated lecture on foreign water supplies. The incinerator at the Aurora sewage-treatment plant was described by Walter A. Sperry. C. A. Velzy described the newly installed grease tank at the Springfield sewage plant. The River des Peres drainage project in St. Louis was described by W. W. Horner. H. W. Harman described some operating experiences at two small sewage plants, one at a municipal sanitarium and the other at the plant of the Caterpillar Tractor Co. at Peoria.

Colorado River Aqueduct Roadway Contract Awarded

The first contract to be awarded by the board of directors of the Metropolitan Water District of Southern California on the $220,000,000 Colorado River aqueduct project has been given to the Martin Brothers Trucking Co., of Long Beach, Calif., low bidder at $13,055 on a contract to construct 6½ miles of roadway to connect the line of the projected aqueduct with the Mecca-Blythe state highway. Eleven firms submitted bids, the highest being $41,433. The contract provides that work cannot be started until money is available from the $220,000,000 bond issue voted by member cities of the district in September, 1931, validation of which is now before the courts.

Engineers Named to Investigate Baltimore's Water Supply

The Board of Estimates, Baltimore, has approved appointment by the Public Improvement Commission of three engineers to make a study of plans for an additional water supply for the city. They are Prof. John H. Gregory, of Johns Hopkins University; J. G. Requardt, of the engineering firm of Whitman, Requardt & Smith, and Abel Wolman, chief engineer of the Maryland state department of health. The engineers will be given free rein in making their investigations and recommendations.

W. S. Mitchell, River Engineer, Dies in St. Louis

William Selby Mitchell, 75 years old, prominent river engineer in the Mississippi Valley and a government employee for 54 years prior to his retirement because of age on Nov. 1, 1931, died of heart disease on Jan. 27 in St. Louis, Mo.

Mr. Mitchell entered government service at the age of 20, and on Aug. 14 had completed 54 years of continuous service, always at St. Louis in the engineer department at large, serving in various capacities through all the engineering grades from recorder to principal engineer. From 1917 to 1919, during the World War, he was district engineer in charge of the U. S. Engineer Office at St. Louis. He served as engineer and member of the U. S. Towboat Board and was a member of the board that investigated the sinking of the steamer "Norman," belonging to the Memphis Engineer District.

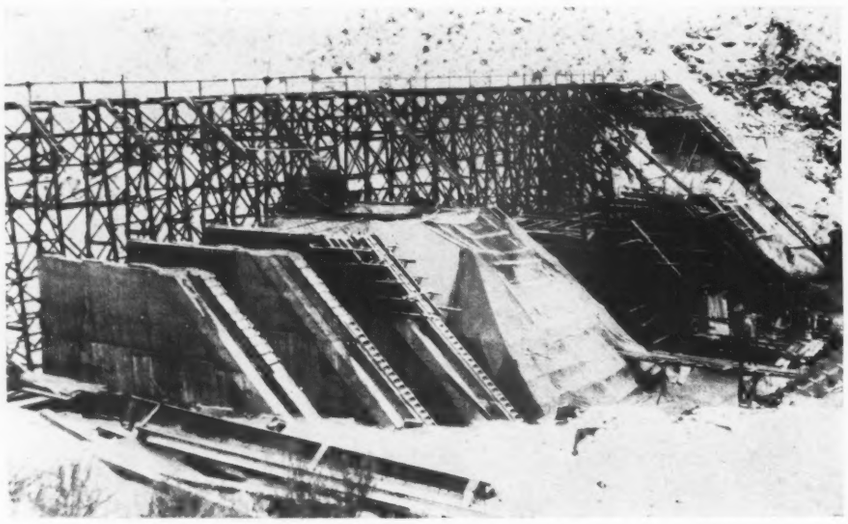
He designed and constructed large hydraulic pipeline dredges, towboats and river fleets, and designed for the upper Mississippi River service a fleet of four all-steel towboats of unusual size and power and nineteen of the largest steel barges in existence on inland waters at the time of their construction. For the Missouri Southern Railway he designed and constructed the large railroad car ferry "Kellogg."

Mr. Mitchell was a member of the St. Louis Engineers Club and the American Society of Civil Engineers, having been president of the St. Louis section of the latter society in 1921.

Specification Writing Course at C.C.N.Y.

A course in specification writing is to be given at the College of the City of New York during the spring term of 1932 for civil engineering students, engineers and architects. It will include: (1) a study of the steps preliminary to the making of an engineering contract, such as the advertisement, information to bidders and the proposal; (2) a detailed consideration of the various general and specific clauses of a set of specifications, together with the theoretical and practical reasons for incorporating such clauses; (3) a study of the city ordinances which affect the drawing of specifications; (4) an analysis of specifications used in actual engineering projects.

The course will be given by Nathan Young, counselor at law, on Thursday evenings, beginning Feb. 11, from 7:25 to 9:18 o'clock. The fee is $10, and students not matriculated at the college may register up to Feb. 9.



WINTER CONSTRUCTION ON THIEF VALLEY DAM, OREGON

Concrete placing has proceeded on the Thief Valley Dam, being built by the Bureau of Reclamation in eastern Oregon, in spite of severe winter conditions. The illustration shows 2,000 sq.yd. of canvas inclosing fresh concrete and heated by coke in salamanders. For a ten-day period snow closed the roads, and teams and sleds were resorted to for bringing in supplies. The dam is of the slab-and-buttress type 70 ft. high and 396 ft. long. The W. H. Puckett Co., Boise, Idaho, is the contractor.

Construction Cost and Volume Index Numbers

E.N.-R. Cost		E.N.-R. Volume	
Feb., 1932	**161.82**	**Jan., 1932**	**121**
Jan., 1932	162.48	Dec., 1931	133
Feb., 1931	196.61	Jan., 1931	208
1931 (Average)	181.25	1931 (Average)	220
1930 (Average)	202.85	1930 (Average)	260
1913 average	100.00		

Charles Camsell Elected Head of Canadian Engineers

Charles Camsell, deputy minister of mines, Dominion of Canada, was elected president of the Engineering Institute of Canada at its annual meeting held in Toronto Feb. 3-5. Mr. Camsell is a native of western Canada and has spent much of his life in survey and exploration work in the Canadian Northwest. He was born at Fort Liard, Northwest Territory, was graduated from the University of Manitoba in 1894 and took post-graduate courses in geology at Queen's University, Harvard University and Massachusetts Institute of Technology. From 1894 until 1900 his time, outside of his post-graduate studies, was spent in exploration work throughout the basin of the Mackenzie River and the region west to the Pacific Coast. In 1900 he joined a geological survey party on Great Slave Lake and in the following years did exploration work for the Algoma Central Railway in the Moose River valley and for the Canadian Northern Railway in western Ontario and northern Manitoba. In 1904 Mr. Camsell joined the Canadian Geological Survey, with which he remained until in 1920 he was appointed deputy minister of mines and made his headquarters at Ottawa. Mr. Camsell is one of the Canadian representatives on the Niagara Board.

San Francisco-Oakland Bridge Project Making Progress

Final permission for a right-of-way across Yerba Buena Island by the war department and the calling of a second meeting of the consulting board indicate the steady progress being made on the San Francisco-Oakland bridge project. Approval of the route across the island by Secretary Hurley was in accordance with the act of Congress authorizing the general location, which placed final decision up to the departments of war, navy and commerce; permission is understood to include the indorsement of all three departments. The consulting board, announced in *ENR* Oct. 8, 1931, p. 590, began sessions Jan. 25 and will consider matters of foundation, design and approaches based on data and studies which have been prepared since its first meeting in October.

During the past two months foundation borings on pier locations have been pushed and 60 per cent of the contemplated subaqueous exploration has been completed. Work to date includes 1,000 ft. of diamond drilling, 3,000 ft. of jet boring and 1,000 ft. of dry sampling. Single test piles and clusters are being driven to determine foundation conditions in the shallow water section east of Yerba Buena Island. The nine-pile groups will be loaded under a control arrangement so that test load distribution can be equalized on the individual piles by means of jacks. Drilling is also under way along the line of the San Francisco approach section and the Yerba Buena Island crossing.

Design studies have been made for several variations of suspension type of structure for the 7,500-ft. major section between San Francisco and the island. These studies have been carried to the comparative stage, including designs for a single long span, multiple spans and two shorter spans with common central anchorage. The design problem is considerably more involved than for a location calling for a single span crossing with a practically predetermined span length, because the distance makes possible innumerable combinations of design and greatly increases the work necessary to place all of these plans on a comparative cost basis. The results of these studies are now before the consulting board and it is probable that certain eliminations will be made which will permit more detailed design studies on a reduced number of plans.

Concurrently, the problems at the approaches are being given serious consideration. The project will require major alteration of transportation and highway facilities on both sides of the bay.

Chicago Drawbridge Operation

Drawbridges at the sixteen crossings of the Chicago River in the loop or business district were opened 24,613 times in 1931, as against 36,339 times in 1930, with an average delay to street traffic of 3½ minutes for each operation. The highest record was reached in 1929, with 49,148 openings.

Obituary

JAMES H. FUERTES, designer of many sanitation works in the United States, Canada, Hawaii and Brazil, died at his home in Brooklyn, N. Y., on Jan. 27 at the age of 68. Mr. Fuertes was graduated in civil engineering from Cornell University in 1883 and in his early career was connected with railroad work in the West and Southwest. Among the more important of his later works were reports on the sanitary improvement of the city and port of Santos, Brazil, and on the water supply for New York City and for Philadelphia. As consulting engineer to the board of public works of Harrisburg, Pa., he planned and built for that city a water-purification plant and sewage interceptors. He designed and built gravity water-supply works for Lynchburg, Va., and Cumberland, Md., and was a member of two commissions to report on the water supply of Winnipeg, Man.

EDWARD S. WALSH, of Brooklyn, N. Y., former superintendent of public works of New York State, died on Jan. 26 after an illness of a year and a half. In 1923, after a consolidation of several state departments, Mr. Walsh became commissioner of canals and waterways, but resigned soon afterward. He was 57 years old.

EDWARD J. GOVERN, of Rochester, N. Y., for the last five years expert for the New York State Public Service Commission, died on Jan. 27.

FLOYD H. ROOD, chief engineer for Boehm Brothers, contractors, Buffalo, N. Y., died on Jan. 24. Before going to Buffalo eight years ago Mr. Rood was district engineer for the Pittsburgh Testing Laboratories. He was 41 years old.

ROBERT F. WEITBREC, who served as treasurer of the Denver & Rio Grande R.R. (now Denver & Rio Grande Western) during its formative period nearly 60 years ago and who later was construction superintendent of the system, died at his home in Denver recently. He was 83 years old.

ANDREW J. STACEY, of Cincinnati, vice-president and director of the Stacey Bros. Gas Construction Co. and director of the Stacey Manufacturing Co., subsidiaries of the International-Stacey Corp., died on Jan. 18 at the age of 73. Mr. Stacey was recognized as an authority on machinery and gasholders used in the manufacture and distribution of manufactured and natural gas.

HENRY S. STEPHENS, of the civil engineering firm of Ingersoll & Stephens, of Cleveland, Ohio, died suddenly on Jan. 25 of heart disease. Mr. Stephens was a major in the engineering service in the World War, most of his service being with the 61st Engineers in charge of railroad operation. He also served with the 311th Engineers, the 65th Engineers and the 31st Engineers. For a time he was commanding officer in the Rennes district.

CARL FREDERICK WESTERBERG died of cancer on Jan. 25 in a hospital in Washington after an illness of several years. Mr. Westerberg was 37 years old. After his graduation from Sheffield scientific school of Yale University in 1913, Mr. Westerberg was for some years associated with the R. W. Hibbard Construction Co., of New York. He represented it and other concerns in Panama, Venezuela, Colombia and other Latin American countries, taking part in railroad and other construction work. He was one of those associated with the construction of the Chiriqui Railroad in Panama.

GEORGE REYER, superintendent of waterworks of Nashville, Tenn., died in that city on Jan. 20 at the age of 75. Mr. Reyer first became superintendent of the Nashville waterworks in 1881, remaining until 1898. He then went to Birmingham, Ala., and took charge of the privately owned waterworks of that city. In 1902 he resigned this position and returned to Nashville, becoming associated with Foster & Creighton, engineers and contractors. After three years he became superintendent of the New York Suburban Water Co., which supplied Mount Vernon and other municipalities near New York City. In 1908 he returned to Nashville to take charge once more of its water-supply system, which under his direction has been greatly extended and improved, including the recent addition of a filtration plant.

SOCIETY CALENDAR

AMERICAN CONCRETE INSTITUTE, Detroit; annual convention, Washington, D. C., March 1-4.

AMERICAN RAILWAY ENGINEERING ASSOCIATION, Chicago; annual convention, Chicago, March 15-16.

AMERICAN SOCIETY FOR TESTING MATERIALS, Philadelphia; annual meeting, Atlantic City, June 20-24.

NATIONAL PAVING BRICK ASSOCIATION, Washington; annual meeting, Chicago, Feb. 10-12.

Current Prices of Construction Materials

Price advances since last month are indicated by **heavy type**; declines by *italics*

Building Materials

PORTLAND CEMENT—Prices per barrel, for cement in cloth, *without including charge for four bags at 10c. each.* Cash discount not deducted. Prices are delivered by truck to contractors at site of job:

	Feb. 4, 1932	One Mo. Ago	One Yr. Ago
Atlanta	$2.25	$2.25	$2.38
Baltimore	1.87	1.87	2.60
Birmingham	2.40	2.40	2.60
Boston	2.00	2.00	2.35
Chicago	1.55	1.55	2.20
Cincinnati	1.60	1.60	2.26
Cleveland	1.25	1.25	2.80
Dallas	1.88	1.88	2.15
Denver	2.40	2.40	2.20
Detroit	1.90	1.90	2.60
Jersey City	1.79	1.79	2.33
Kansas City	2.00	2.00	2.15
Los Angeles	*2.30*	2.50	1.92
Minneapolis	*2.10*	2.15	2.50
Montreal	2.18	2.18	2.20
New Orleans	2.01	2.01	2.35
New York	1.60	1.60	2.20
Philadelphia	1.95	1.95	2.15
Pittsburgh	1.81	1.81	2.15
St. Louis	*1.85*	2.00	2.15
San Francisco	2.44	2.44	2.64
Seattle	2.20	2.20	2.25

Current mill-prices per barrel to dealers, in carloads, without including charge for four cloth bags, f.o.b.:

Alpena, Mich	$1.20	Mason City, Ia	$1.10
Buffington, Ind	1.10	Norfolk, Va	1.61
Dallas, Tex	1.74	Northampton, Pa	1.21
Hannibal, Mo	1.10	North Birmingham, Ala	1.31
Hudson, N. Y	1.21	Richard City, Tenn	1.31
Independence, Kan	1.10	Steelton, Minn	1.61
Ironton, Ohio	1.06	Universal, Pa	1.21
Iola, Kan	1.10	Waco, Tex	1.60
La Salle, Ill	1.10	Wyandotte, Mich	1.20
Limedale, Ind	1.10		

SAND AND GRAVEL—Per ton, delivered. Gravel, sizes ¼-in. or 1½-in.:

	Gravel	Sand
Atlanta	*$2.50*	$2.25
Baltimore	2.35@2.55	2.08
Birmingham, per cu.yd., 2,600@2,800 lb.	*2.75*	*2.25*
Boston	1.40@1.75	1.00@1.20
Chicago, per cu.yd., 3,000 lb.	1.65	1.65
Cincinnati	1.50	1.25
Cleveland, per cu.yd., 3,000 lb.	2.00	2.00
Dallas, per cu.yd., 2,750 lb.	2.25	2.25
Denver, per cu.yd., 2,700 lb.	1.80	1.35
Detroit	1.65	1.50
Kansas City	2.00	2.00
Los Angeles	2.20	1.50@1.70
Minneapolis, per cu.yd., 2,800 lb.	1.70@2.40	1.00
Montreal	1.50	1.25
New Orleans, per cu.yd., 2,700 lb.	2.02½	1.28
New York, per cu.yd., 2,800@3,000 lb.	2.75	1.75
Philadelphia	2.35@3.20	1.55@2.40
Pittsburgh	1.55	1.75
St. Louis	1.65	1.35
San Francisco	1.75	1.75
Seattle, per cu.yd., 2,900@3,000 lb.	1.85	1.85

CRUSHED STONE—Per ton, size 1½-in., limestone, delivered:

Atlanta	$3.00
Baltimore	2.60
Birmingham	*Slag used*
Boston	1.75@2.00
Chicago, per cu.yd., 2,500 lb.	1.65
Cincinnati	2.25
Cleveland	2.50
Dallas, per cu.yd., 2,500 lb.	2.90@3.00
Denver, granite, per cu.yd., 2,700 lb.	2.50
Detroit	1.95
Kansas City	2.00
Los Angeles	2.20
Minneapolis, per cu.yd., 2,600 lb.	2.40
Montreal	1.80@2.00
New York, per cu.yd., 2,800@3000 lb.	2.75
Philadelphia	2.30@3.15
Pittsburgh	3.25
St. Louis	1.65
San Francisco, trap rock	1.65
Seattle, per cuyd., 3,000 lb.	3.00

CRUSHED SLAG—Prices for carloads, per net ton, at plant:

	1½-In.	¾-In.	Roofing	Sand
Birmingham, Ala.	$0.90	$1.15	$2.05	$0.55
Buffalo District	1.25	1.35	2.25	1.25
Cleveland, Ohio	1.10	1.10	2.25	.70
Western Pennsylvania	1.25	1.25	2.00	1.25
Toledo, Ohio	1.10	1.10	1.10	1.01
Youngstown District	1.25	1.35	2.00	1.25

CONCRETE BLOCKS—Standard, 8x8x16-in., hollow, delivered to job, each:

Birmingham (5x8x12)	$0.084	Kansas City	$0.18
Boston	.16@.20	Minneapolis	.10
Brooklyn and Queens	.12	New Orleans	.18
Chicago	.23	Philadelphia	.18@.25
Cleveland	.16@.17	Pittsburgh	.20@.26
Denver	.22	St. Louis	.14
Detroit	.12		

HOLLOW TILE—Building tile per block, delivered to contractors in lots of 2,000 pieces or over:

	4x12x12	6x12x12	8x12x12	10x12x12	12x12x12
Atlanta	$0.09	*$0.11*	*$0.13*	$0.20	$0.25
Baltimore	.105	.....	.20	.....	.23
Birmingham	.089	.122	.167	.219	.25
Boston	.08	.115	.15	.21	.325
Chicago	.048	.066	.09	.117	.13
Cincinnati	.06815	.09485	.129	.165	.184
Cleveland	.048	.066	.09	.117	.13
Dallas	.091	.121	.159	.19	*.234*
Denver	.0975	.135	.175	.2125	.25
Detroit	.08	.11	.145	.19	.215
Kansas City	.088	.11	.145	.19	.215
Los Angeles	.09425	.134	.188	.2325	.3115
Minneapolis	.0787	.1034	.1343	.1643	.2284
New Orleans	.085	.115	.16	.225	.255
New York	.075	.125	.14	.....	.....
Perth Amboy, N. J.(f.o.b.)	.....	.....	.....	.2388	.2956
Philadelphia	.105	.14	.215	.28	.34
Pittsburgh	.041	.058	.0845	.111	.12275
St. Louis	.068	.098	.12	.16	.20
San Francisco	.0765	.105	.1765	.....	.....
Seattle	.085	.115	.18	.....	.....

BRICK—Prices delivered per thousand are as follows:

	Common	Front	Paving F.O.B. 3x8½x4-in.	Paving F.O.B. 3½x8½x4-in.
Atlanta	$14.00	*$20.50*	$32.00	$37.00
Baltimore	12.50	25.00@35.00	40.00	43.00
Birmingham	13.50	22.50	27.00	32.00
Boston	14.00	28.00	47.50	52.50
Chicago	12.00	32.50	*32.00*	*38.00*
Cincinnati	16.00	24.00	35.00	37.00
Cleveland	12.00@14.00	21.00@28.00	33.00	36.00
Dallas	13.50	21.00	.....	35.00
Denver	9.00@10.00	25.00	.....	.....
Detroit	15.00	25.00	25.00	35.00
Kansas City	14.00	20.00	35.00	37.50
Los Angeles	*8.00*	26 50	.....	.....
Minneapolis	*9.50*	30.00	.....	.....
Montreal	28.00	.....	.....	.....
New Orleans	*12.50*	.....	40.00	45.00
New York	11.50	30.00	45.00	50.00
Philadelphia	16.00	.....	40.00	45.00
Pittsburgh	12.00	22.00	41.00	58.00
St. Louis	14.00	22.00	35.00	35.00
San Francisco	14.00	.....	45.00*	.....
Seattle	14.00	.....	48.50	61.00

*2½x8½x4-in.

LIME—Prices delivered to job:

	Hydrated, Per Ton—Finishing	Hydrated, Per Ton—Common	Lump, Per Barrel—Finishing	Lump, Per Barrel—Common
Atlanta	*$18.50*	*$11.50*	.....	$2.50†
Baltimore	22.00	14.00	.....	2.25†
Birmingham	30.00	17.50	.....	2.00†
Boston	21.50	14.50	$4.00*	3.10*
Chicago	13.00	*12.00*	1.50†	*1.25†*
Cincinnati	13.05	10.70	.....	.....
Cleveland	12.00	10.00	2.50†	2.50†
Dallas	20.00	.....	*2.40†*	.....
Denver	30.00	23.75	3.80*	3.00†
Detroit	13.00	12.00	1.65†	1.55†
Kansas City	19.00	18.00	2.25†	2.00†
Los Angeles	26.00	18.00	2.00†	2.00†
Minneapolis	25.50	21.00	.....	1.70†
Montreal	18.00	10.00	.....	.....
New Orleans	22.00	13.00	2.10†	1.95†
New York	16.00	13.00	4.10*	3.15*
Philadelphia	18.00	14.50	18.00‡	14.00‡
Pittsburgh	13.50	13.00	4.25*	2.75†
St. Louis	18.00	16.00	.....	12.50‡
San Francisco	17.30	17.30	.....	1.57†
Seattle, paper sacks	35.00	24.00	.....	2.80†

*Per 280-lb. bbl. (net). †Per 180-lb. (net). ‡Per ton.

LIMESTONE—Mill blocks, f.o.b. siding, per cu.ft.:
New York: Rustic buff, $1.37; Standard gray, $1.47; Standard, $1.57; Selected gray, $1.57; Selected buff, $1.67.
Boston: Rustic buff, $1.45; Standard, $1.58; Selected buff, $1.71.
Pittsburgh: Rustic buff, $1.03; Standard, $1.18; Selected buff, $1.28.

SLATE—Roofing, f.o.b. quarry, Bangor, Pa., net, per square:

No. 1 Clear	$9.00@$14.00
No. 1 Ribbon	7.50@ 10.25
Medium Clear	8.00@ 10.50

Road and Paving Materials

PAVING STONE—Granite, lots of 50,000 blocks, 4x8x4-in., dressed, f.o.b. city:

Atlanta	$3.00 per sq.yd.
Baltimore	3.00 per sq.yd.
Birmingham	76.25 per M.
Boston	105.00 per M.
Chicago, 5 in.	*3.80* per sq.yd.
Cincinnati	110.00 per M.
Cleveland	90.00@100.00 per M.
Detroit, 5 in.	3.00 per sq.yd.
Kansas City	*2.75* per sq.yd.
Minneapolis, 4½ in.	2.80 per sq.yd.
Montreal	104.75 per M.
New Orleans	2.80 per sq.yd.
New York, 5 in.	120.00 per M.
Philadelphia	105.00 per M.
St. Louis, 5 in.	*3.00* per sq.yd.

Current Prices of Construction Materials

Road and Paving Materials—Continued

WOOD-BLOCK PAVING—Prices, f.o.b., in carloads:

	Size of Block	Treatment	Per Sq.Yd.
Atlanta	3½	16	$2.25
Boston	3½	16	2.25
Chicago	3½	12	1.80@2.00
Kansas City	3½	16	2.00
Minneapolis	3½	16	2.50
Montreal	3½	16	2.63
New Orleans	3½	16	2.30
New York	3½	14	1.90
St. Louis	3½	16	2.10

FLAGGING—Alongside dock, New York, per sq.ft.:
Manhattan and Bronx, 4 ft. wide....$0.24 Queens, 5 ft. wide..... $0.26

CURBING—Prices per lin.ft., f.o.b., cutting charges not included:
New York: Bluestone, f.o.b. barge, straight, 5x16-in., rough, 85c.
Birmingham: Granite, straight, 5x16-in., 50c.; 6x20-in., 60c.; roundings, 5x16-in., 65c.; 6x20-in., 80c.
St. Louis: Class "B" straight, 5x16-in., 80c.; roundings, $1.15.

ASPHALT—Paving asphalt, f.o.b., per ton. Packages are 350-lb. bbl. or 425-lb. drums, in carload lots:

	Packages	Tank-car or -boat
Atlanta	$18.60	*$14.60*
Baltimore (f.o.b. refinery)	16.00	12.00
Birmingham (f.o.b. refinery)	.....	*12.00*
Boston	22.00	17.50
Chicago	22.50	*15.50*
Cincinnati	.....	12.00
Cleveland	*18.25*	*14.50*
Dallas	27.50	.....
Denver	27.50	.....
Detroit	16.68	12.43
Kansas City (f.o.b. refinery)	16.00	11.00
Los Angeles (f.o.b. refinery)	18.00	12.00
Maurer, N. J. (Bermudez)	.....	25.00
Maurer, N. J. (Trinidad)	.....	21.00
Minneapolis (f.o.b. Twin Cities)	23.30	18.10
Montreal	17.00	13.00
New Orleans (f.o.b. refinery)	*16.00*	*12.00*
New York (f.o.b. refinery)	16.00	12.00
Philadelphia	16.00	12.00
Pittsburgh	24@26	14@18
St. Louis	22.50	18.50
San Francisco (f.o.b. refinery)	18.00	12.00
Seattle	21.40	18.00

LIQUID ASPHALT—Residual, prices f.o.b., in tank cars, 8,000 gal. minimum, 45% asphalt, per gal.:

New York	$0.05
Birmingham	.06
St. Louis	.04
Dallas	.05

Iron and Steel

PIG IRON—Furnace, No. 2 foundry, per gross ton:

	Current	Mo. Ago	Yr. Ago
Birmingham	$10.00@$12.00	$11.00	$14.00
Buffalo	15.00@ 16.00	15.00	17.50

STRUCTURAL STEEL—Prices per 100 lb., delivered from warehouse except in Birmingham and Pittsburgh, where prices are f.o.b. mill. Beams and channels, 3 to 15 in; angles 3 to6-in., ¼-in. thick; tees, 3-in. and larger; and plates, ¼-in. thick and heavier:

Birmingham	*$1.65*	New York	$2.35
Chicago	3.00	Pittsburgh	1.50
Cleveland	2.95	St. Louis	3.25
Dallas	3.25	San Francisco	2.90

BARS, CONCRETE REINFORCING—Prices per 100 lb., delivered from warehouse except in Birmingham and Pittsburgh, where prices are f.o.b. mill, on bars rolled from billets, size ¾-in.:

Birmingham	$1.75	New York	$2.35
Chicago	1.65	Pittsburgh	*1.50*
Cleveland	1.75	St. Louis	3.00
Dallas	2.75	San Francisco	2.50

EXPANDED METAL LATH—Per 100 sq.yd., painted, delivered to job:

Lb. Per Sq.Yd.	New York	Birmingham	Chicago	St. Louis	Dallas	San Francisco
2.2	$11.00	$17.50	$10.60	$16.00	*$14.50*	$21.50
2.5	12.00	18.50	11.40	17.00	*16.50*	22.50
3.0	13.00	20.50	12.65	18.50	.....	25.00
3.4	14.00	22.00	13.65	19.25	*20.00*	27.00

TRIANGLE MESH—Plain, per 100 sq.ft., 4 in. x 4 in. Manufacturers' quotations are in carloads at mills; dealers' are delivered in lots of 10,000 sq.ft. or over:

Style Number	Weight in Pounds Per 100 Sq.Ft.	Pittsburgh Mill	Chicago District Mill	Del. From Warehouse: New York	St. Louis	Dallas	San Francisco
032	22	$0.89	$0.91	$1.21	$1.30	*$1.31*	$1.22*
049	28	1.13	1.16	1.55	1.70	*1.60*	1.55*
068	35	1.39	1.42	1.80	2.10	*1.80*	1.91*
093	45	1.78	1.83	2.31	2.65	*2.30*	2.46*
126	57	2.20	2.26	2.85	3.30	*2.82*	3.03*
153	68	2.63	2.69	3.41	3.95	*3.36*	.....
180	78	3.01	3.09	3.92	....	*3.85*	.....

*F.o.b.

STEEL SHEETS—Prices per 100 lb. for base sizes, delivered from warehouse, except in Pittsburgh, where prices are f.o.b. mill:

	Hot-rolled No. 10	Hot-rolled No. 24	Galvanized No. 24
Chicago	$3.20	$3.55	$4.10
Cleveland	3.00	3.60	3.75
New York	2.65	3.50	4.00
Pittsburgh	*1.75*	*2.15*	*2.80*
St. Louis	3.45	3.80	4.35
San Francisco	3.65	4.15	4.65

WIRE ROPE—Discounts from manufacturers' list price on regular grades of bright and galvanized, Eastern Territory, New York, and East of Missouri River; list prices are per ft. on size ⅜ in.:

	List	Base
Cast steel round strand rope	$0.12½	20 %
Galvanized iron rigging and guy rope (add to list)	.04½	12½ %
Galvanized steel rigging and guy rope	.10½	7½ %
Plow steel round strand rope	.13	35 %
Round strand iron and iron tiller	.09	5 %
"Special Steel" and extra strong cast steel, round strand rope	.15½	27½ %

Discount 5 points less than discount for Eastern territory: California, Colorado, Kansas, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, Texas, Washington and Wyoming. Discount 10 points less than discount for Eastern territory: Arizona, Idaho, Montana and Utah.

RIVETS—Structural rivets, round head, ½-in., full kegs, per 100 lb., delivered from warehouse, except in Pittsburgh, where prices are f.o.b. mill:

Chicago	$3.75
Dallas	4.50
Denver	4.65
New York	4.00
Pittsburgh	2.25
St. Louis	4.00
San Francisco	5.00
Seattle	4.50

STEEL SHEETPILING—Base price, f.o.b., Pittsburgh, for large mill lots, per 100 lb..... $1.90

TERNE PLATE—I C, 8-lb. coating, 20x28-in., f.o.b., Pittsburgh mill:
Per package..... $9.50

SHIP SPIKES—Per 100 lb., black, from warehouse stocks; galvanized are about $1.75 per 100 lb. higher:

	½-In.	⅝-In.	¾-In.
San Francisco	$5.50	$5.05	$4.90
Seattle	7.75	5.65	5.50

Pittsburgh mill base in lots of 200 kegs or more, $2.90 per 100 lb.

WIRE NAILS—Per 100 lb. keg, base, delivered from warehouse stocks; also Pittsburgh mill base:

Pittsburgh	Birmingham	Chicago	St. Louis	Dallas	San Francisco	Montreal
$1.95@$2.00	$2.40	$3.30	$2.40	*$3.10*	$2.75	$4.95

SCRAP—The prices following are f.o.b., per gross ton, paid by dealers:

	New York	Chicago	Detroit
No. 1 railroad wrought	$5.00	$6.50*	.....
Stove plate	3.00@4.75	6.25*	*4.50*
No. 1 machinery cast	8.50†	8.50*	8.50*
Machine shop turnings	*1.00*	4.00	4.00
Cast borings	*1.00*	3.50	4.50
Railroad malleable	6.00	7.00	.....
Re-rolling rails	6.00	10.50	9.00
Heavy melting steel, No. 1	4.25	7.50	7.00
Iron and steel pipe	5.00	4.50	.....

*Net ton. †Delivered direct to foundries.

FREIGHT RATES—The following freight rates per 100 lb., effective Dec. 3 1931, apply on finished steel products in the Pittsburgh district, including plates, structural shapes, merchant-steel bars, pipe fittings, plain and galvanized wire nails, rivets, spikes, bolts, flat sheets (except planished), chains, etc.:

Atlanta	$0.58*	Detroit	$0.265†
Baltimore	.27†	Kansas City	.57†
Birmingham	.58*	New Orleans	.67*
Boston	.40†	New York	.35†
Buffalo	.235†	Pacific Coast (all rail)	1.15‡
Chicago	.34†	Philadelphia	.29†
Cincinnati	.265†	St. Louis	.39†
Cleveland	.185†	St. Paul	.59*
Denver	1.15‡		

*36,000 lb. †40,000 lb. ‡60,000 lb..

Railway Materials and Supplies

STEEL RAILS—Standard rails have been $43.00 per gross ton since Sept., 1922 at which time the price was $40.00; other rails, per gross ton, f.o.b., as follows:

	Pittsburgh	Birmingham	Chicago
Light rails, 25 to 45 lb.	$34.00	$33.00	$34.00
Re-rolled rails	24.00@28.00	24.00@28.00	32.00

RAILWAY TIES—Prices f.o.b., per tie, for carload lots:

		6 In. x 8 In. by 8 Ft.	7 In. x 9 In. by 8½ Ft.
New York	Long-leaf sap pine, untreated	*$0.90*	*$1.10*
	Dense yellow pine, untreated	.70	.90
Birmingham	White oak, untreated	.90	1.05
	White oak, creosoted	1.45	1.55
	Southern pine, untreated	*.35*	*.85*
	Southern pine, creosoted	.95	*1.30*
Chicago	White oak, untreated	1.05	1.35
	Oak, empty cell, creosoted	1.40	1.80
	Oak, zinc treated	1.25	1.65
	Southern pine, creosoted	*1.15*	*1.50*
St. Louis	White oak, untreated	.80	1.30
	Red oak, untreated	.75	1.20
	Red oak, creosoted	1.10	1.70
	Sap pine or cypress, untreated	.60	*1.60*
San Francisco	Douglas fir, green, untreated	.50	.68
	Douglas fir, empty cell, creosoted	1.22	1.64
Montreal	Birch or maple, untreated	.75@1.25	.75@1.25
	Birch or maple, creosoted	1.20@1.30	1.50@1.60

Current Prices of Construction Materials

Railway Supplies—Continued

TRACK SUPPLIES—Prices per 100 lb., f.o.b., for large mill lots at Pittsburgh and Birmingham, together with warehouse prices at other places named:

	Pittsburgh	Birmingham	Chicago	St. Louis	San Francisco
Standard spikes, ⅝-in. and larger	$2.70	$2.70	$3.45	$3.65	$4.10
Track bolts	3.80	3.70	4.30	4.50	5.10
Standard section angle bars, splice bars or fish plates	2.75	3.00*	5.75	.....	.....
Tie plates	1.95	2.07½	1.95†	.....	.....

*At warehouse. †At mill.

Pipe

WROUGHT STEEL PIPE—Discounts from standard lists for delivery from warehouse, except at Pittsburgh, where prices are f.o.b. mill. List prices per ft. as follows: 1-in., 17c; 3-in., 76½c; 3½-in., 92c; 6-in., $1.92.

	1 to 3-In. Butt Weld		3½ to 6-In. Lap Weld	
	Black	Galvanized	Black	Galvanized
Chicago	57.25%	44.71%	53.83%	41.29%
Cleveland	53.3%	42.3%	50.8%	37.8%
New York	56.14%	43.6%	52.72%	40.18%
Pittsburgh	64%	52.5%	61%	49.5%
St. Louis	51%	38%	48%	35%

CAST-IRON PIPE—Prices per net ton, for bell and spigot pipe, Class B and heavier, f.o.b., on regular lots (250 tons and under) of pipe:

	4-In.	6-In. and Over
Birmingham mill	$35.00@$36.00	$32.00@$33.00
Burlington (N. J.) mill	35.00@ 36.00	32.00@ 33.00
Chicago	43.00@ 44.00	40.00@ 41.00
New York	38.00	35.00
Pittsburgh	43.50@ 44.50	40.50@ 41.50
St. Louis	42.80	39.80
San Francisco	43.00@ 44.00	40.00@ 41.00

Gas pipe and Class A, $3.00 per ton extra.

SEWER PIPE—Prices delivered per foot, for standard pipe; 6, 8 and 12-in. are single strength and 18, 24, 30 and 36-in. are double strength:

	6-In.	8-In.	12-In.	18-In.	24-In.	30-In.	36-In.
Atlanta	$0.125	$0.21	$0.385	.....	.....	.....	.....
Baltimore	.10	.30	.58	.....	$1.95	.....	$6.50
Birmingham	.18	.30	.54	$1.02	1.95	$3.50	5.00
Boston	.18	.28	.55	1.35	2.375	3.95	5.90
Chicago	.18	.28	.54	1.25	2.25	4.75	6.00
Cincinnati	.135	.21	.405	1.05	1.89	3.456	5.4325
Cleveland	.1125	.175	.3375	.825	1.485	4.824	7.38
Dallas	.23	.325	.586	1.106	1.95	3.68	5.00
Denver	.161	.23	.414	.816	1.44	.....	.....
Detroit	.18	.28	.55	1.35	2.60	4.75	.....
Kansas City	.21	.335	.52	1.00	1.90	3.60	.....
Los Angeles	.217	.2825	.4985	1.1865	2.034	3.93	.....
Minneapolis	.155	.24	.50	1.15	1.85	3.45	4.60
Montreal	.30	.45	.75	1.95	2.60	.....	7.20
New Orleans	.17	.28	.52	1.00	1.90	.....	.....
New York	.17	.265	.52	1.30	2.34	4.47	6.86
Philadelphia	.0945	.147	.297	.80	1.44	2.304	3.28
Pittsburgh	.1575	.245	.54	1.25	2.25	4.68	7.17
St. Louis	.1295	.235	.423	1.05	1.80	3.20	4.40
San Francisco	.21	.30	.54	1.26	2.16	3.60	5.40
Seattle	.22	.30	.54	1.26	2.16	2.50	5.50

CLAY DRAIN TILE—Prices delivered per 1,000 lin.-ft.:

Size, In.	New York	Birm'ham	Pittsburgh	Chicago	St. Louis	San Fran.	Seattle
4	$42.00*	$50.00	$80.00	$40.00	$50.00	$67.50	$69.00
6	75.00*	85.00	110.00	100.00	85.00	112.50	112.00

*F.o.b.

Miscellaneous

LINSEED OIL—Raw oil, f.o.b., in 1- to 4-bbl. lots, per lb.:
New York ..... *$0.075* Minneapolis *$0.083*

WHITE AND RED LEAD—Base price per 100-lb. keg, f.o.b., New York: White, dry, $12.00; White in oil, $12.00; Red, dry, $12.00; Red, in oil, $13.50.

CHEMICALS—Water, sewage treatment, road work, f.o.b., carlots, New York:

Bleaching powder, in drums, f.o.b. works, per 100 lb.	*$1.75*
Calcium chloride, flaked, in drums, f.o.b. works, per ton	21.00
Chlorine, cylinders, per lb.	.04
Silicate of soda, in drums, f.o.b. works, per 100 lb.	1.35
Soda ash, 58%, in bags, per 100 lb.	1.15@1.17½
Sulphate of aluminum, in bags, per 100 lb.	1.25
Sulphate of copper, in bbl., per 100 lb.	3.10

MANILA ROPE—The number of feet per pound for the various sizes is as follows: ¾-*in.*, 6-ft., 1-in.; ½-*in.*, 4-ft., 5-in.; *1-in.*, 3-ft., 8-in.; 1½-*in.*, 2-ft., 5-in.; 1½-in., 1-ft., 8-in. Following prices are per lb. for ½-in. and larger:

Atlanta	$0.25	Kansas City	$0.23
Baltimore	.225	Los Angeles	.175
Birmingham	.25	Minneapolis	.18
Boston	.20	Montreal	.185
Chicago	.175	New Orleans	.19
Cincinnati	.21	New York	.17
Cleveland	.21	Philadelphia	.21
Dallas	.22	St. Louis	.175
Denver	.20	San Francisco	.175
Detroit	.185	Seattle	.175

BUILDING PAPER—Black, 50-lb. per roll of 500 sq.ft., in carloads, f.o.b., producing point $2.16

SLATERS FELT—In carloads, per roll, f.o.b., producing point $1.79

PREPARED ROOFING—Prices, delivered to contractors, in carloads, f.o.b New York, per square:

Single shingles, slate finish, sufficient to cover 100 sq.ft.	$6.50
Strip shingles, 4 in 1, hexagonal shape, with Underwriters' label	6.25
Slate surfaced roofing in rolls weighing 85 to 90 lbs.	2.50

ROOFING MATERIALS—Prices, f.o.b. New York, delivered to contractors, in carloads:

Asphalt felt, per 100 lb.	*$2.40*
Tar felt, per 100 lb.	*2.50*
Asphalt coating, per gal.	.34½
Tar pitch, in 350 lb. barrels, per ton	28.00

WINDOW GLASS—Discounts from latest jobbers' window-glass list, dated Sept. 15, 1928, at New York warehouse:

	Single Thickness		Double Thickness	
	A Quality	B Quality	A Quality	B Quality
First 3 brackets	89%	91%	88%	90%
Larger sizes	88%	90%	88%	90%

EXPLOSIVES—Price per pound for dynamite delivered:

	Gelatin 40%	Gelatin 60%		Gelatin 40%	Gelatin 60%
Atlanta	$0.22	$0.245	Los Angeles	$0.1725	$0.1925
Baltimore	.215	.2375	Minneapolis	*.18*	*.205*
Birmingham	.135	.1575	Montreal	.17	.195
Boston	.225	.25	New Orleans	.195	.22
Chicago	.17	.195	New York	.245	.2675
Cincinnati	.22	.245	Philadelphia	.215	.24
Dallas	.185	.21	St. Louis	.1975	.2175
Denver	.19	.2125	San Francisco	.155	.18
Kansas City, Mo.	.2025	.2225	Seattle	.1525	.175

Lumber

Prices Are Delivered, Per M Ft., B. M., No. 1 Common, Rough

New York—Timbers, to contractors, at site of job in Manhattan, in 20 ft. lengths and under:

	Long-leaf Yellow Pine	Douglas Fir
3x4 to 8x8	$45.00	*$27.00*
3x10 to 10x10	52.00	*28.00*
3x12 to 12x12	63.00	*28.00*
3x14 to 14x14	70.00	*33.00*

Chicago—Timbers, pine, in 20 ft. lengths and under; fir, up to 32 ft:

	Long-Leaf Yellow Pine	Douglas Fir
3x4 to 8x8	$42.50	$42.50
3x10 to 10x10	49.50	44.50
3x12 to 12x12	62.50	44.52
3x14 to 14x14	72.51	45.50

San Francisco—Douglas fir timbers:

	10-16-18 and 20 Ft.	22 and 24 Ft.
3x3 and 4	$35.00	$37.00
3x6 and 8	35.00	37.00
3x10 and 12	35.00	37.00
3x14	38.00	39.00

Other Cities—Timbers, boards, etc.:

	8x8-In. x 20 Ft. and Under				3x12 to 12x12-In. 20 Ft. and Under	
	Pine	Fir	Hemlock	Spruce	Pine	Fir
Atlanta	$40.00	.....	.....	.....	$55.00	.....
Baltimore	35.00	$48.00	$52.00	$58.50	72.00	$48.00
Birmingham	46.00	.....	.....	.....	76.00	.....
Boston	50.50	46.00	46.50	48.00	56.50	43.00
Cincinnati	42.50	55.00	.....	.....	52.50	52.50
Cleveland	54.00	54.00	.....	.....	52.00	52.00
Dallas	55.00	47.50	55.00	55.00	55.00	47.50
Denver	.....	*.31@.50*	55.00	.....	.....	*.43@.55*
Detroit	53.00	51.00	.....	.....	63.00	51.00
Kansas City	35.00	35.00	35.00	.....	55.00	40.00
Los Angeles	.....	41.50	.....	.....	.....	42.50
Minneapolis	.....	46.25	.....	.....	.....	46.25@47.75
Montreal	.....	41.75	.....	40.00	40.00	41.75
New Orleans	38.00	38.00	.....	43.00	63.00	58.00
Philadelphia	45.00	42.00	36.00	40.00	55.00	40.00
Pittsburgh	53.00	57.00	65.00	66.00	43@57	57@60
St. Louis	42.50	41.50	38.00	.....	57.00	42.50
Seattle	.....	16.00	.....	.....	.....	15.00

	1x10 In. x 16 Ft. and Under			2x10 In. x 16 Ft. T. & Gr.	
	Pine	Fir	Hemlock	Pine	Fir
Atlanta	$50.00	.....	.....	*$32.50*	.....
Baltimore	52.00	$43.00	$42.00	.....	.....
Birmingham	40.00	.....	.....	55.00	.....
Boston	46.00	41.00	41.50	47.00	$45.00
Cincinnati	45.00	47.50	.....	35.00	45.00
Cleveland	44.00	37.00	37.00	42.00	54.00
Dallas	60.00	.....	.....	55.00	.....
Denver	.....	*31.00*	36.00	.....	45.00
Detroit	48.00	45.00	.....	43.00	43.00
Kansas City	40.00	40.00	.....	35.00	33.00
Los Angeles	41.50	41.50	.....	.....	48.50
Minneapolis	65.00*	40.00	.....	45.00*	39.00
Montreal	45.00	43.25	40.00	.....	38.25
New Orleans	39.00	39.00	.....	54.00	48.00
Philadelphia	48.00	40.00	35.00	49.00	40.00
Pittsburgh	40.00	47.00	55.00	40.00	50.00
St. Louis	*37.50*	42.50	42.50	*29.50*	*33.00*
Seattle	.....	15.00	.....	.....	16.00

*Northern Pine, No. 2 Com.

PILES—Prices of Nichols Bros., 90 West St., N.Y.C., per linear foot, pine, with bark on, f.o.b., New York; delivered from barge, 1¼ to 2c. per ft. additional:

Dimensions	Points	Length	Barge	Rail
12 in. at butt	6 in.	30 to 50 ft.	$0.10	$0.165
12 in.—2 ft. from butt	6 in.	50 to 59 ft.	.145	.215
12 in.—2 ft. from butt	6 in.	60 to 69 ft.	.17	.235
14 in.—2 ft. from butt	6 in.	50 to 69 ft.	.205	.345
14 in.—2 ft. from butt	6 in.	70 to 79 ft.	.2225	.295
14 in.—2 ft. from butt	5 in.	80 to 85 ft.	.285	.395
14 in.—2 ft. from butt	5 in.	85 to 89 ft.	.325	.435